Environmental auditing and the labelling of products and packaging

A design management model for corporate decision makers

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TEXT CUT OFF IN ORIGINAL

ABSTRACT

This thesis is concerned with demonstrating the relationship between strategic environmental management and the design of paper packaging products. It provides a design management led process model that improves the use of ecological packaging design to support a companys' environmental philosophy and activities.

At present there is no environmental award for paper based packaging. The EU packaging and packaging waste directive came into force in 1996 placing responsibilities on packaging producers to deal with the waste they produced but without giving clear guidelines for the design of the packaging. Concurrently Environmental Management Standards (EMS) were established to assist businesses to deal with environmental commitments but with little examination at the product stage and no specifications for design. Thus the importance of the relationship of product design and packaging to the company's environmental philosophy is currently underestimated.

The research undertaken has been both conceptual and empirical. Two surveys were conducted, investigating attitudes and clarifying user needs in relation to auditing methodologies about packaging products and the different levels of environmental performance, activities and commitments in the packaging business. The proposed model was developed and tested repetitively in different formats during observational studies and interviews. A summative and critical evaluation of the results provides the final synthesis of the model. An assessment matrix for paper based packaging products is explored to indicate a possible direction for future research for measuring performance.

This thesis argues that the *Environmental Management Control System* (EMCS) *model*, allows businesses to manage and audit their business environmental activities compatible with the packaging design process. The EMCS is an operational, structural, fundamental model that relates environmental management principles with the packaging design process. The EMCS *model* incorporates five subsidiary models in support of the main model, that provide specifications for environmental auditing activities; methodology for operation at the internal and external environmental communication level; specifications for the operation at the product level and specifications for the operation for packaging design. This model represents the principal findings and the new thinking offered by the research.

The main argument of this thesis is that the management of design process should be developed to be compatible with the formulation of business environmental philosophy. The generic solution model accepted by the users is a foundation for developing an understanding of the links between organisational capabilities to manage their environmental performance and using design for competitive advantage.

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I would like to express my sincere thanks to the people and organizations that responded to the research enquiries, the people that participated in the interviews and surveys in particular the interviewees in the testing and evaluation of the model(s) too many to list. I would like to acknowledge that the information and comments provided assisted the research process and without this material the work could never be completed.

Finally many thanks goes to my family and friends for their love and emotional support. I would like to thank my parents for their financial support and encouragement to continue for Ph.D. research, after completing my MA studies. Many thanks to my mother Popi, for being strong and supportive to me, and for her advice and strength that gave me. Many thanks to my sister Lila for being able to cope with me and my stress for the two years we lived together, many thanks for all her love and experiences we share together and for the things we manage to learn about life. Many thanks to my brother Dimitri for his love and good words. Many thanks also goes to my partner Jeremy and his family for their help and encouragement during the finally stage of my research.

This thesis is dedicated to Panagioti D, Sarri

This study is dedicated to the memory of my father, a very special person, a person who has been a wonderful husband and father, a person who has been loved and admired by many people, a person who loved life in every sense and be able to appreciate any small pleasure in life. A person who has fight hard to achieve and create all that life gave to him. A person that served the society with integrity and honesty as a judge for many years. A person who has been so giving to me for all his life, and because of his encouragement and support I started this study. Even if he is no longer with me in this small planet, his memory will always be in my heart and his principles and advice will be with me all my life long.

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AUTHORS DECLARATIONS

1. During the period of registered study in which this dissertation was prepared the author has not been registered for any other academic award or qualification.

2. The material included in this dissertation has not been submitted wholly or in part for any academic award or qualification other than that for which it is now submitted.

3. The programme of advanced study of which this dissertation is part has consisted of:

A. Independent studies.

B. Supervision tutorials.

All the above were held in the Faculty of Art and Design, Graduate School of Design and Manufacture, De Montfort University.

C. Attendance in relevant research conferences

D. Participation in Research Colloquia

Sarri, E.

March 1999

Acronyms and Abbreviations used in the text

BRC: British Retail Consortium

BUAV: British Union for the Abolition of Vivisection

CBI: the Confederation of British Industry

CEP: Council for Economic Priorities (US)

CEPI: Confederation of the European Paper Industries

CNAA: Council for National Academic Award

DfE: Design for the Environment

DMI: Design Management Institute

DTI: Department of Trade and Industry

ECA: Environmental Choice Australia

Eco-Design: Ecological Design

Eco-S: Eco (*Ecological*) Scale/System

EIA: Environmental Impact Analysis/ Assessment

EIA: Institute of Environmental Impact Assessment

EIC: the Environmental Industries Commission

EIE: Environmental Impact Evaluation

EMAS: Environmental Management and Audit Scheme

EMCS: Environmental Management Control System (*model*)

EMS: Environmental Management Standards

EMSs: Environmental Management Systems

EPA: Environmental Protection Agency (US)

ERPA: European Recovery & Recycling Association

IDFORUM: Industrial Designers Forum

IDSA: Industrial Designers Society of America

Acronyms and Abbreviations

IEM: Institute of Environmental Management

IIED: International Institute for Environment and Development

INCPEN: Industry Council for Packaging and the Environment

IOCU: International Organisation of Consumer Unions

IOP: Institute of Packaging

IRRC: Investor Responsibility Research Centre

ISO: International Standards Organisation

LCA: Life Cycle Analysis/Assessment

LCI: Life Cycle Inventory

MEPA: Measuring Environmental Products Acceptability (*model*)

NNC: National Consumers Council

NSSC: Neutral Sulphate Semichemical

OECD: Organisation for Economic Co-operation and Development

OJ: Official Journal

PIRA International: *formerly* Paper Industry Research Association

PRG: Producer Responsibility Industry Group

SCS: Scientific Certification System's

SEC: US - Securities and Exchange Commission

SWAP Save Waste and Prosper

TQEM: Total Quality Environmental Management

TQM: Total Quality Management

UKEB: UK Ecolabelling Board

CHAPTER 1. INTRODUCTION*Research Framework*

1.1 Introduction

This thesis is a communicates the findings, the process and the methodology of the Ph.D. research work titled *"Environmental auditing and the labelling of products and packaging - A design management model for corporate decision makers"*. The study is conducted for the Faculty of Art and Design, Graduate School of Design and Manufacture at De Montfort University, between May 1995 and March 1999.

The process of the research was presented in major international refereed conferences including, '*Whose Values?*' - Ethics in the International Business Environment, London, organised by Thames Valley University; (Sarri, E. & Holland, R., March 1996), Worldesign '96 Conference - *'Alternative Realities'*, USA, organised by the Industrial Designers Society of America (Sarri, E. & Holland, R., Sept. 1996), 'Business Strategy and the Environment Conference', UK, organised by the ERP Environment (Sarri, E. Holland, R. & Stewart, J., Sept. 1996), 'The 8th International Forum on Design Management Research and Education', Spain, organised by the Design Management Institute (Sarri, E. & Holland, R., Nov. 1996), 'Contextual Design/ Design in Context conference', Sweden, organised by The European Academy of Design (Sarri, E. & Holland, R., April 1997), the 'Eco-Management and Auditing Conference' UK, organised by the ERP Environment (Sarri, E. & Holland, R., July 1998). The research has also been published in a special dedicated refereed article (Sarri, E., Nov./Dec. 1997, p 4-9) in the TIES, Magazine of Design & Technology Education, The George Lucas Education Foundation, America.

What this thesis is about? - it is a description of the research progress in formulating a model for managing and auditing the design process compatible with business corporate environmental missions. It starts by describing existing research in chapter 2., that generated different hypothesis paths, which arose from the review of existing published and unpublished (personal communication) information sources. These hypotheses are tested at the preliminary stage presented in chapter 4, by conducting an exploratory survey and a number of interviews grouped in two categories: a) evaluating methodology for ***environmental labelling*** with regards to paper packaging products and b) evaluating methodology for ***environmental auditing*** with regards to paper packaging products. At the preliminary stage of this research study (see Chapter 4.) it found out that the supported theory by the EU Ecolabelling scheme for development environmental awarding (ecolabelling) for packaging materials was not the way forward for packaging design. In

particular the EU Competent body in Italy started in 1994 studies for environmental awarding of packaging materials. Indeed what was proven was that the management of packaging design aiming to achieve sustainability goals needs better understanding of business environmental philosophy and vice versa. The analysis and observation of the survey and interviews enabled the researcher to formulate the next stage of research inquiries, where a number of options related to methodology on environmental awarding for paper and board packaging were tested with packaging companies and designers.

The results of that stage of inquiry (chapter 5.) led to the formulation of different types of models of environmental analysis that were presented in design and business seminars, observed and discussed by the participants and subsequently evaluated in a range of specific interviews (*for each different format of the model*) with packaging companies, industrial and governmental bodies. To gain more understanding of environmental management systems and the effects in packaging design process a second survey was conducted, presented in chapter 6., under the heading of principal investigation. The findings and observations from these research activities enabled the researcher to formulate the final model and the implementation proposals for its use. The final model was tested within a carefully selected audience and is presented in chapter 7. In addition, a proposed method as an extension in the use of the model presented in chapter 8.

1.2 Purpose and Framework of the Research

This part explains the problem with which this research is concerned. The main research questions arise from the literature review (see chapter 2.) and the preliminary study (see chapter 4.) that includes the exploratory survey, personal communication and, interviews with the industry. The research objectives are given and the conceptual framework and hypothesis paths that are followed are explained.

1.2.1 Problem Definition

Current discussion about environmental issues in the packaging business are concerned with the increase in legislation by the EU on packaging and packaging waste, standards on environmental management systems, governmental plans, certain codes of conduct, accepted norms in practice, ideologies and certification bodies of knowledge. Thus creates an enormous pressure for business to radically rethink their corporate environmental activities.

Unfortunately, whilst businesses have accepted the general need for environmental and social responsibility, in some cases it has not been translated into meaningful action. For example, organizations appear to be simply 'exploiting' consumers' environmental awareness and concern i.e. changing their market claims [on product and packaging] without modifying or improving the 'environmental qualities' of their products/packaging or production system; products and packaging sometimes carry fake, misleading and unrealistic 'green' claims;[1] Efforts need to be directed towards controlling manufacturers' claims on products and packaging through guidelines or codes of practice within a legislative framework.

Packaging materials [including paper packaging] has been defined as a category for awarding an environmental label by the EU ecolabelling scheme (UK Ecolabelling Board, 1996). Apparently several industries have complained about the slow progress of the scheme in allocating labels on products (Smith M, 1997: 99). The UK Eco-labelling Board's (UKEB) in its own publicity newsletter referred to the scheme's progress as *'slow and frustrating'*.[2]

The paper industry agreed to an Eco-label for copying paper, after considerable prevarication and objections stemming largely from the US and European paper manufacturers. However industry trade association has argued that the label addressed the production process and not the product and packaging. They were concerned that the scheme will interfere with existing national and independent labelling schemes, and thereby reduce the impact of the EU label (Smith M, 1997: 102-103).

The paper industry preferences are towards the adoption of the Environmental and Management Auditing Scheme (EMAS), which they claim to be a more reliable indication of the industry itself, and not limited to its products[3]. Despite this they do acknowledge the potential of the supply chain pressure which could influence future directions[4].

The interest in labelling schemes has not been limited to the EU, prior to the Rio 'Earth Summit' in 1992, the International Standards Organisation (ISO) was asked to contribute to meeting the targets of sustainable development through standardisation in environmental management tools, that includes product labelling. The ISO interpreted the use of labelling

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[1] See Research paper 'Environmental business strategy - A new model for development?' (Sarri E., and Holland R., 1996). For work that examines green advertising or labelling concentrated on the issue of unsubstantiated and misleading environmental claims see Kangun et al, 1991 and Strid & Cater, 1993. Also, 'Green Claims' (1996) Report from the National Consumer Council that finds environmental claims on products and packaging often to be woolly, meaningless, unverifiable, open to multiple interpretations, confusing, or of no real benefit.
[2] UKEB Newsletter, No 6, March 1994: 1
[3] ENDS Report, No. 243, April 1995: 33
[4] ENDS Report, No. 257, June 1996: 26

as a tool to prevent manufacturers from making false claims and providing consumers with independent information.

However, ISO sets an ambitious series of objectives to achieve the use of environmental labelling as a part of the ISO 14001 series, which include the application of voluntary standards, aiming to avoid the creation of unintended international trade barriers. It is interesting to note, however that the objectives of the ISO family 14000 are very common to those set for the EU Eco-label. But, the European experience to-date indicates concerns about implementing those objectives and making easy assumptions about problems that are emerging in implementing the ISO 14001 at international level.

The starting point for a new generation of procurement standards is to prompt industry participation (Suton, 1993; Sayre D, 1996) in creating environmental management systems with respect to the final product. In relation to this, Principle 1, of the ISO 14000 states that:

> *"an organisation should focus on what needs to be done - it should ensure commitment to the Environmental Management System and define its policy".*

According to Sayre in the book 'Inside ISO 14000' (1996: 59) the environmental programme of an organisation should deal with any environmental consequences from past activities of the organisation and with development of new products or services throughout their life cycle. The long terms benefits of the ISO 14000 is that it is focused on regulatory compliance; or limiting sources of liability; or making more efficient the use of materials.

Therefore it would be meaningful for an organisation to reinforce the approach in the use of materials, energy and product/packaging design, regardless of the system that the entire organization operates. It appears that for adequate management of the design process the environmental effects of the life cycle of the product should be considered well in advance, aiming to be adaptable by and to enhance the business environmental profile. Furthermore, environmental management systems should be formulated in providing specific guidelines in support of the design of environmental improvements of products and services.

1.2.2 Main research Questions

Based on these recommendations the study formulates methods for environmental analysis and auditing within the packaging design process for the managerial decision - making level for companies.

The basic question for this research study is: *What is required for packaging businesses (and thus packaging design respectively) in order to develop specific methodologies and standards for assessing the environmental impact of their products and production systems?* For the study to give an answer it is necessary to explore four more questioning areas supporting the argument, as follows:

1. ***Methodology in environmental accreditation on products and packaging.*** What is the existing methodology for environmental labelling of products and packaging? (desk research) Is this methodology efficient to accredit paper based packaging? (field research) What alternatives can be formulated? (observations and evaluation) Are the suggested alternatives appropriate for environmental awarding paper based packaging? (field research - testing)

2. ***Environmental management systems and business operation.*** What is in existence about environmental management systems? (desk research) and how does this affect packaging business? (desk and field research) Is the existing development of environmental control systems on packaging business satisfactory? (field research) The current research (evaluation of desk research) recommends that companies can claim 'environmental credentials' for a particular product and packaging, when there is no doubt that the company ignored environmental parameters in other sectors. Based on this recommendation, what about business overall environmental impact? and, how is this related to the final product/packaging? (field research). In addition, how do packaging businesses audit their environmental activities related to the final product? What problems are they facing in implementing these activities? What recommendations can be made? (field research)

3. ***Eco-design and Paper based packaging.*** Are there enough (quantitative and qualitative data) for paper packaging industry and designers to move towards the creation of environmentally acceptable products? (desk research) Are designers and managers of design in the position to assess the environmental performance of packaging? What is required by them to move towards this direction? (field research) In what format should the environmental analysis for packaging be? (field research and testing) What are the pitfalls that the companies should avoid? What is the more efficient, economically effective way for environmental investment for paper based packaging? (field research and testing)

4. ***Relationship of business environmental policies with the final product packaging.*** There are different levels of company environmental commitment (from 'Green' to 'Dark Green') there are also, products with different environmental impact that carry an environmental label. The questions are: What is best format for the product to be viewed as a part of the sub-system that the organization operates? and, What particular methodologies are required to develop a way to assess the differentiation of products negative impact on the environment? (field research and testing)

1.2.3 The Research Objectives

Based on the foundation above a research framework is proposed to define; examine; evaluate; measure and test the effectiveness of conducting environmental analysis and ecological assessment as a part of business activities, for paper packaging products and material. The following five objectives describes the proposed framework.

1st To examine the context of environmental labelling schemes, life cycle analysis/assessment methodology, eco-auditing, and the position of all the parties effected.

2nd To assist a 'cradle-to-grave' analysis of environmental performance of paper packaging products in relation to companys' policy.

3rd To develop and test specific criteria for Life Cycle Analysis and Eco-Assessment for paper based packaging.

4th To build a model for environmental analysis and ecological auditing, as a basis for testing results for paper packaging products as a part of companies environmental management strategy.

5th *To explore the application of the model by an assessment matrix based on Case Studies of paper packaging companies approach which sets out key environmental criteria for the life-cycle stages (pre-production through to disposal).*

The above objectives are related with the research activities in chronological order. The first objective sets out to examine the existing methodology for environmental analysis while the second objective examines the environmental impact of paper based packaging in relation to company's environmental policy and activities aiming to identify and generate specific research inquiries. Desk research, personal communication with relevant organisations and the first survey are used for this purpose. The third objective evaluates different hypothesis paths based on the findings of the above inquiries. Field research and interviews are used in that stage.

The principal research aim is given in the fourth objective. This fourth objective is of a significant importance as it brings out the new thinking - the main argument, which is the model of environmental analysis compatible with packaging design process that this research is concerned with. Field research including experimental studies interviews and the second survey are used in that stage. The fifth objective, in support of the fourth objective, an exploration of how the theoretical, structural model *may* be used in practice.

The *main argument* of the thesis is that the environmental impact of the paper packaging should be addressed by auditing a companys' strategic environmental activities. To award a label on a product for its environmental qualities is of limited value unless it is for macro-environmental objectives set by the company towards continuous environmental improvements. It is possible to develop a *conceptual* framework from the above objectives in order to focus the crucial role that sustainability in packaging development and design is playing towards the creation of environmental management systems.

1.2.4 Conceptual Framework and Hypothesis Paths

The purpose of the study focuses on four main areas of investigation delivered from the research objectives. The relationship of those four main areas of investigation is illustrated on the following page in Figure 1.1 *'The conceptual framework of the research'*, which includes:

1*st* The company's environmental policy. - ABSTRACT. Investigation directed into companies' corporate environmental policies and the level of managerial decision making. The goal in this part is to identify strengths and weakness related to the environmental analysis and assess the effects of environmental initiatives on the final product.

2*nd* The paper packaging product. - ARTEFACT. The investigation is about the products environmental performance; environmental qualities; and eco-efficiency options;

3*rd* Methodology for ecological auditing. - ABSTRACT. The investigation into existing ways of environmental analysis and labelling systems (environmental awards). By developing *models* of environmental analysis (see chapter 5 and 7 for different stages on model development and final outcomes) during the progress of the research and testing the different stages of the development of the models, recommendations are made about methods to reinforce the approach of environmental auditing (chapter 7 and 8).

4*th* Results. After observational studies and testing the evaluation of the research findings a *model* is formulated for industry to implement environmental management methodologies; - ABSTRACT. The model may be used to generate an assessment matrix to assess the environmental performance and qualities of paper - cardboard packaging products (through case studies of products) - ARTEFACT.

As described in the sections above the research investigates attitudes related to companies environmental policy and environmental information with regards to packaging design. The aim is to assess this product category (packaging paper products) and to establish a *'credible way'* to use products environmental information. The National Consumer Council (1996) recommend:

> *"If the packaging industry is to sort out some levy system to deal with its recycling commitments, perhaps it could also consider financing a system for monitoring and adjudicating misleading environmental claims on products."*

The National Consumer Council comment on this as a result of their research (1996) conducted into misleading environmental claims on products. As a result, the need for introducing a system of controlling environmental information on paper packaging products is merely emphasised.

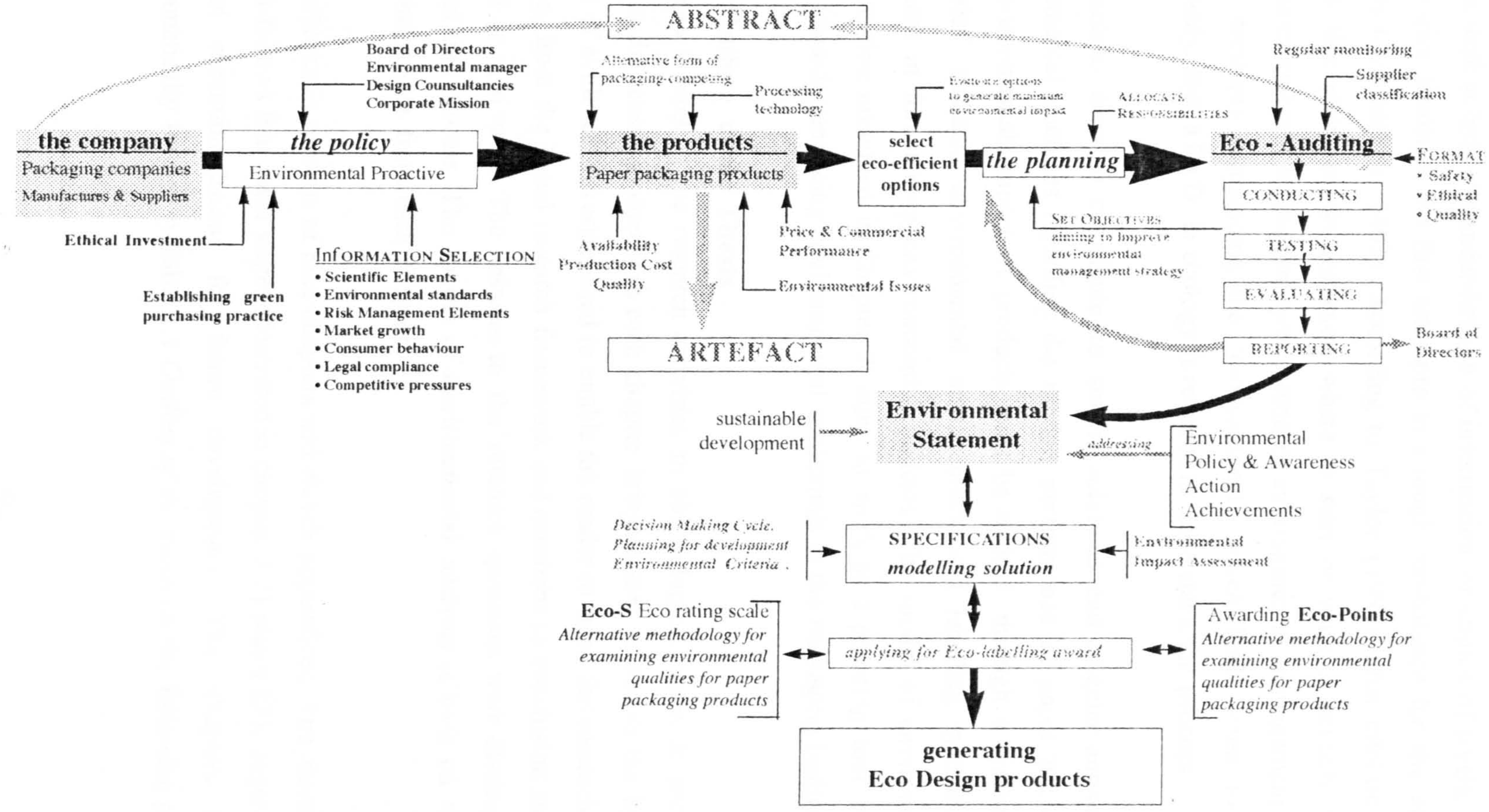

Figure 1.1 The conceptual framework of the research

The current research recommends that more inputs are required in terms of establishing methods in awarding environmental labels and assessing products and packaging environmental performance. In 1989 Norsk Hydro published an environmental investigation of its Norway operations, and in 1990 a UK environmental report. It has been criticised that even if this type of publication makes it easier for outsiders to find points to criticise, such as lack of standardization of information or choice of levels, the report does at least give details of the first attempts at a rough eco-balance for the company's main products (Hopfenbeck, 1993). According to Taylor (1994) what inhibits action more is perhaps, that managers do not know where to start or what to actually do. This bar to action is exacerbated by the embryonic state of environmental management practice, and a certain mystique surrounding the 'environment' which leads some to believe, quite erroneously, that a Ph.D. in ecology is required to understand the process.

The research aims to contribute to simple solutions and singular answers to complex environmental concepts regarding the market performance of paper packaging products. The environmental impact of products must be studied through a systems approach to companies' strategic environmental management, and labelling systems should be an instrument in formulating environmental policies. The model of environmental analysis (final solution presented in Chapter 7) aims to work as a planning tool for a substantial change towards generating environmental credentials in the packaging business sector.

1.3 Outline of the Thesis

The thesis is built on the research activities in chronological order. It presents the work related to the research objectives each chapter brings a step to add to the hypothesis path. A chain of evidence was established to enable the reader to trace the research steps in either direction, from the initial research framework and questions to conclusion and results of the research or vice versa. The answers to the research questions were discovered during the course of this process. The model of environmental analysis is built on the basis of the conclusion drawn from each chapter.

The whole thesis consists of nine chapters and eleven appendices. The development of the research follows four main stages (described in chapter 3.2) plus a fifth stage that deals with proposed recommendations for future development. The chapters are shown in diagrammatically format in Table 1.1 *Outline of the thesis* on the following page.

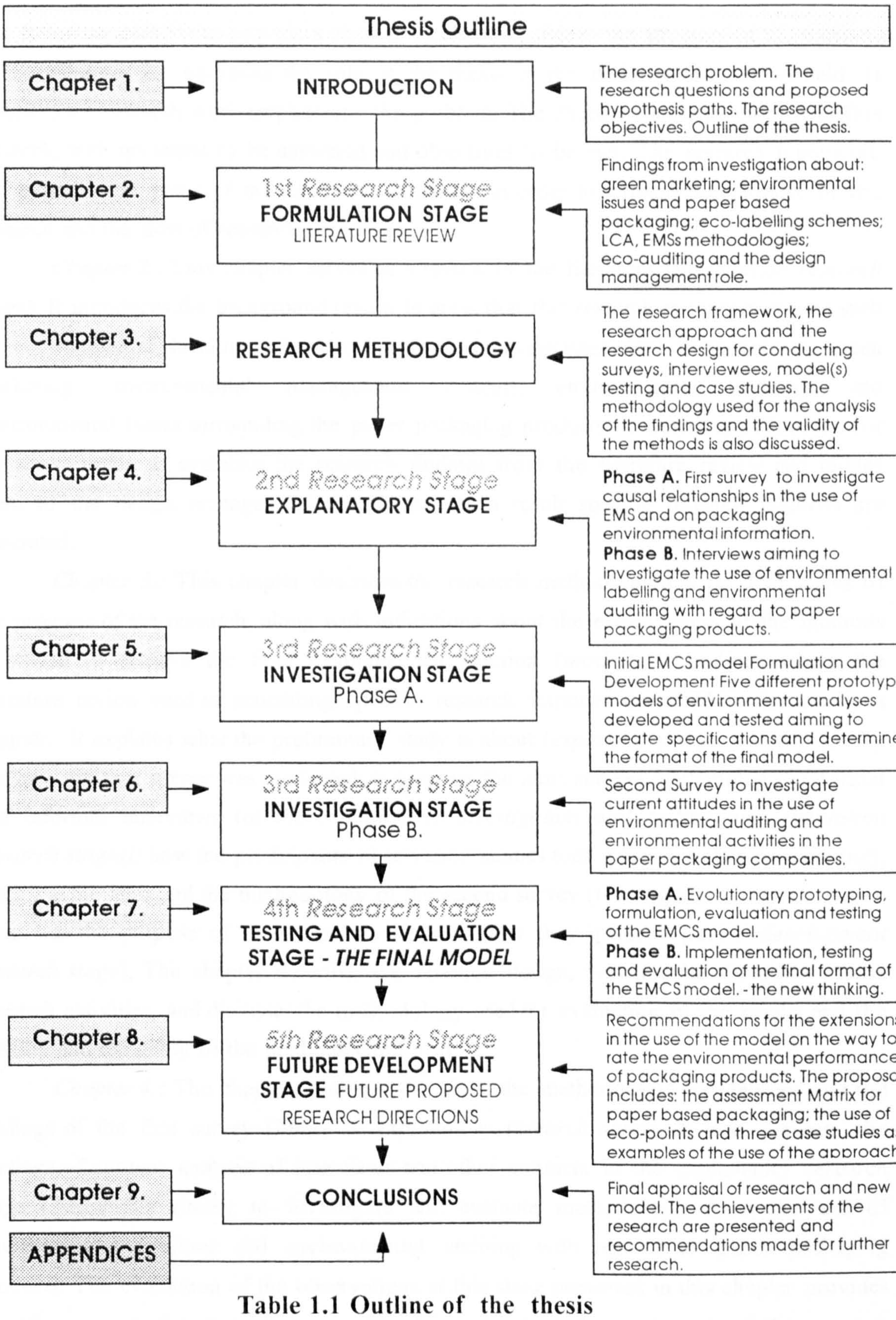

Table 1.1 Outline of the thesis

The following paragraphs provide a chapter by chapter guide to the structure of the thesis.

Chapter 1.: Addresses the role of the thesis in the design management field. It describes the research work emphasising the problem. The chapter states the purpose of this research, with questions to be answered and objectives to be met. The research framework and hypothetical paths of influence are discussed, in order to explain the purpose of the research and the flow of research objectives.

Chapter 2.: This chapter serves as a review of the literature (*formulation research stage*). It introduces the background review in areas that this research is concerned with such as: environmental labelling schemes; life cycle analysis/assessment methodology; green marketing; environmental management systems; environmental auditing; and environmental issues surrounding the paper packaging products. It describes definitions for the above terms. It evaluates the research findings from the literature review and relates them to the design management scepticism. As a result specific research inquiries are generated.

Chapter 3.: This chapter describes the research methods used in the five stages of the progress of the research, along with indications about the effectiveness of the methods employed to achieve the final recommended solution (*model*). It outlines where the literature review used in generating specific research inquiries described in the previous chapter. It explains what the preliminary study is about (*explanatory research stage*), why and how the first survey was conducted; It presents the aims and the methodology of formal and informal interviews (*at the explanatory, investigation and testing and evaluation research stages);* how the participants observation studies took place (*models prototyping*); what was the aims and the methodology of the second survey (*investigation research stage*); what was the purpose of the case studies and what they present *(future development research stage*); The chapter describes the research design, presents the timetable of the research activities, and discusses the methodology used for evaluation of the results and the validity and reliability of the methods employed.

Chapter 4.: The chapter presents the aims; the methodology; the analysis and the findings of the first survey (*Phase A. explanatory research stage*). It also, presents the findings of content analysis of interviews and other contacts in the explanatory research stage (*Phase B.*) aiming to investigate and evaluate methodology about the use of environmental labelling and environmental auditing with regards to paper packaging products. The evaluation of the observations at this stage presented in this chapter provides specific research directions that aimed to be explored in the next stage of the research (*investigation stage*).

Chapter 5.: The methodology of testing and evaluating five different prototype formats of the design management *model* of environmental analysis is given in this chapter (*Phase A. investigation research stage*). In order to test the hypothesis described in chapter 2. and the format of the hypothesis suggested in chapter 4. a multi-faced approach to evaluation is adopted from angles of both communication of the qualities that the models are posing and the understanding and effectiveness of its use by third parties. This approach consists of a set of data collection techniques and differing data analysis methods. The aim of this approach is to create specifications and determine the format of the final model of environmental analysis.

Chapter 6.: This chapter presents the formulation of the second survey (*Phase B. investigation research stage*) investigating methods that business are using to control, audit and manage their environmental activities, in paper packaging sector. The chapter includes the pilot stage of the survey; the outcomes and evaluation; It emphasises how the outcomes and the observations of the survey used in the formulation of the design management *model* of environmental analysis.

Chapter 7.: In this chapter a complete picture of the *model* of environmental analysis is presented. Based on the findings from previous chapters the 'Environmental Management Control System' EMCS *model* is re-formatted, tested and modified (*Phase A. testing and evaluation research stage*). The final solution - that is the EMCS model and sub-models of environmental analysis - is presented, formulated based on the evaluation from Phase A., tested and re-evaluated (*Phase B. testing and evaluation research stage*). Conclusions are reported mainly from interviews and contacts with governmental and industrial bodies.

Chapter 8.: The implementation proposals for the potential extension in the use of the EMCS *model* for paper based packaging is presented in this chapter *(future development research stage*). It suggests a new protocol of 'assessment matrix' and presents three experimental case studies as examples in the use of the matrix. Recommendations for the use of the matrix as a part of the EMCS *model* in rating (by using eco-points) the different levels of businesses environmental concern are made.

Chapter 9.: This final chapter summarises the main achievements of the research presented within the thesis, emphasising the contribution of the EMCS *model.* Conclusions about the role of environmental auditing and eco-labelling are drawn. The chapter provides a critical evaluation of the work, and proposes further research work in the area.

CHAPTER 2. LITERATURE REVIEW *The use of Environmental Information and Environmental Management Systems in relation to Paper based Packaging*

2.1 Introduction

This chapter serves as a review of the literature. It starts with a descriptive definition of terms in the field and shows where this research fits into the area of environmental management systems; design audits; the use of environmental information on products and methodology in assessing paper packaging products environmental qualities. This chapter discusses how the design management scepticism applies in the above mentioned areas.

Following this, we look into some typical applications in the use of environmental auditing in the business and design environment, and attempts to tackle the problem. Finally an approach to easing the problem is proposed. This approach proposes alternative ways for environmental awarding of paper based packaging materials in auditing methodologies that need to be explored. The proposed investigation presented at the end of this chapter is undertaken at the next stage and analysed in chapter 4. This investigation informs the formulation of models of environmental analysis that address and access design activities in the packaging sector.

2.2 The conceptual framework of business green communication

Research indicates that consumers are integrating environmental concerns into their purchasing behaviour in a variety of ways. There is a growing amount of evidence indicating that consumers are choosing products or avoiding others based on their impact on the natural environment (Mintel, 1994; Coddington, 1993; Davis, 1993; McDougall, 1993; Ottman, 1992a; The Roper Organisation, 1990).

There is also evidence that a negative backlash to green marketing has already occurred, with consumers becoming increasingly circumspect about green claims in general (Carlson et al., 1993; Kangun et al., 1991; Rawsthorn, 1990; The Roper Organisation, 1990). If producers of consumer goods are to continue to use green marketing as a strategic tool (Coddington, 1993; McArthur, 1994; McDaniel and Rylander, 1993; Prothero, 1990) they may need to find methods of making these claims more credible in the eyes of consumers.

Environmental labelling is moving in this direction to promote the marketing, design, and use of products and packaging which have a reduced environmental impact, likewise to provide consumers and other buyers with a credible way of identifying products less harmful

to the environment (UK Ecolabelling Board, 1997; EPA, 1993; OJ, No. 880/92; OECD, 1991; Brand New Diagnostic, 1989).

However, while the environmental labelling schemes (e.g. EU Eco-Labelling scheme) provide a "cradle-to-grave" analysis of the environmental performance of products, in the form of Life Cycle Analysis[1] there is concern about organisations overall eco-performance. Ideally, if organization has integrated green marketing into its strategic focus, it would have adopted an environmental corporate culture (Peattie, 1995; McArthur, 1994; McDaniel and Rylander, 1993; McDougall, 1993; Ottman, 1992b).

Ostmeier (1990) indicates that environmentally orientated product innovation ability is a central dimension of corporate environmental management. Eyring, (1993) The Geogressional Office of Technology Assessment notes that:

> *"while green design may be a step in the right direction for creating less waste and less hazardous waste, it alone won't solve the world's environmental problems. We' re not going to save the planet by designing fast food packaging, for example, that's better for the environment, but it's a necessary part of a larger environmental policy".*

Many writers (Roberts, 1995; Crosbie and Knight, 1995; Welford and Gouldson, 1993; North, 1992; Burke and Hill, 1990) have emphasised the importance of an environmental policy as a basis for setting objectives and the fact that the policy should cover all aspects of operation, the need to move from reactive policy goals to proactive goals, the management's commitment to the policy and its transparency.

The environmental management system (EMS) standards such as BS 7750 EMAS and the ISO 14000[2] series promote the practical role of environmental policies. According to EMS standards the environmental policy is a basis for strategic planning. Environmental objectives, targets and programs can be derived from the policy.

Academics have pointed out the need to incorporate wider sustainability goals into the policy (Welford, 1997; 1995; Roberts, 1995). Recently, Ketola (1997) defines the significance of the origin of an environmental policy, on the basis of environmental values and visions of the company.

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[1] The concept of Life Cycle Analysis (LCA) is based on "reduced environmental impact" during the entire life cycle of a product. However no methodology exists to determine the total environmental impact of a product. Draft Proposal for a Council Regulation establishing a revised Community Eco-Label Award Scheme, 2/12/96, p11

[2] BS 7750: British Standards Institution's Specification for Environmental Management Systems; EMAS: European Union's Eco-Management & Audit Scheme; ISO 14000-series: International Organisation for Standardisation's Environmental Management Systems Standards.

Somehow what is missed out, or has not been given enough emphasis is the relationship of the policy to the product itself (what the ISO 14001 series might try to achieve). What is delivered to the consumer is the final product but, it should viewed as a result of a policy with visions and strategic environmental planning. If we really want to manage and achieve the aims of sustainability (discussed below) the companys' policy should be directly related to auditing and managing the design process of individual products.

It is possible on the other hand to come across companies that appear to promote a product and packaging in the market as *'environmentally superior'* compared with others of the same kind. It should be noted, however that it is not always as a result of the environmental commitment of the entire organization, as it may appear to be. In such cases, it is possible for consumers to make different assumptions about the product/packaging or the company related to environmental commitments which do not really exist.

In 1980 John Elkington co-author of the *Green Consumer Guide* predicts *that "in ten years time, I would expect to see more emphasis on a company's environmental performance than on the products."* Actually by 1989 when the demand for green products started to become a new reality, companies flooded the market with products claiming to be green, but not many studies have been undertaken to support the greening of such products. While todays' environmental commitment of business is somewhat controversial, what Elkington foretells is that it might be somehow more important to establish an environmental policy with long term corporate environmental and ethical investment rather than produce products claiming to be green without any standing on ethical and environmental grounds.

By studying the effect of the sum of many parts consisting and influencing the development of a product; process; organisation; system; we can have a better perspective of the whole. In such case several factors must be considered based on a holistic management view. Jan Smut defines holistic management as:

> *"a whole is a synthesis or unity so close that it affects the activities and interactions of those parts, impresses on them a special character, and makes them different from what they would have been in a combination devoid of such unity or synthesis"* [3]

Thus in a holistic view, you cannot have green marketing without green management.

Today the greening of enterprises is implemented through an environmental management system, an eco-audit or the use of a certification of environmental products claims.

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[3] Smuts J, (1926) Holism & Evolution, Macmillan, New York, p 122

The following developments indicate the greening of management as an international movement and not as a passing phase:

⇒ Companies realise the crucial role of environmental factors and examine their activities by reducing environmental cost in every level, from office waste to manufacturing waste. Many companies employ environmental consultancies and external auditors.

⇒ Governmental mandatory laws, international standards and quality control environmental systems that are in place generate a bottom-line concern for companies that want to prosper and be survivors in an era when forced to comply with clean and green ethics.

⇒ According to Arthur D. Little, nearly half of the Fortune 100 companies had a vice president in charge of environmental affairs in 1991, 62 percent among the Fortune 500.[4]

⇒ Federal law in Germany requires that most companies appoint managers of environmental affairs.

⇒ Companies worldwide have used green marketing to expand market share.

⇒ In recent years we see the emergence of corporate alliances with major international marketers. Examples include the McDonald's/ Environmental Fund relationship and The Body Shop/Friends of the Earth arrangement.

In 1993 the New Consumer Institute found that all but a handful of more than 200 multinational consumer companies did not have an environmental policy or environmental programme in place.[5] It is now common for multinationals to have working environmental policies that address a number of issues. But what is difficult for todays' corporation is how to proceed in the efficient implementation of their environmental policy.

The economy of sustainable development

The report 'Our Common Future' (Brundtland 1987) became the landmark of sustainable development.[6] 'Our Common Future' has inspired many parties from economists to ecologists, from industrialists to naturalists as well as pragmatic and philosophers. The concept of 'sustainable growth' is just what industry wants, in terms of a clean public image commensurate with continuing economic growth.

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[4] Ewire, November 16, 1993
[5] Source: New Consumer Institute study, 1993, Wauconda, IL
[6] Sustainable development defined by the Brundtland report (1987: 43) as the *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs"*

In the report from the Consumers in Europe Group (1996) sustainable development is used for describing economic progress in order to have a minimal negative impact on the environment. The majority view, shared by the UK Government and the European Commission, is that it will be possible to maintain and develop a high standard of living.[7]

Economists (like Nijkamp and Soeteman 1988) have introduced with calculations that sustainability and growth at the same time in business are not only possible but also necessary conditions for each other. On the other hand, Friends of the Earth have suggested that continued economic growth that is also sustainable may not be possible and that society should expect to maintain a stable rather than a growing economy.[8] That is based in the development of over consumption patterns as it may be likely that when companies invest in environmental technology, they increase production and consumption and ultimately human impact on environmental degradation.

During a conference held in 1993 by the International Organisation of Consumer Unions (now Consumers International), *'sustainable consumption'* has been presented and it was agreed that consumers had a right to a healthy environment and recognised that, in the long term consumption patterns had to be sustainable.[9] For *'sustainable consumption'*, consumption should be viewed with respect to future generations needs. Such consumption should involve thinking about the impact of every purchase to the natural environment, and consumers may be required to re-think their consuming habits and consume less. Likewise they need to be properly informed about the impact of their purchases through trustworthy on product and packaging information thus enhancing the flow of consumption and helping the growth of environmental economy in the long term.

2.3 The role of packaging in green marketing communication

From a holistic standpoint packaging is not only the container that brings a product safely and hygienically to the market but also represents the whole philosophy of the company's green marketing programme, with it is the packaging colour, shape, size, written information that comes to the fore to influence consumers to purchase a product.

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[7] Consumer in Europe Group (CEG 96/12), 'The consumer interest in the environment - Towards sustainable consumption', p 21
[8] Friends of the Earth, 'Towards Sustainable Europe: A Summary', March 1995
[9] International Organisation of Consumer Unions (IOCU), 'Beyond the Year 2000: The transition to Sustainable Consumption', April 1993

"Packaging is the ultimate symbol of our consumer culture" (Stilwell, 1991: 1). The packaging design differs based on the products country of origin and specific requirements arise related to the use of the packaging and communication characteristics. In any case as Beaumont in his book about marketing and management found packaging is *"a deceptively complex issue, and also a profitable business"*[10]. It is the packaging that provides a means of brand promotion and the medium that communicates the product qualities and gives certain information to the consumer. This is vital to the design management thinking - underpinning the philosophy of this study - and also reflects the entire corporate identity.

"To most consumers, the environment means packaging", said Anthony Casale (1995:7), president of Environmental Research Associates. Packaging is a reason for consumer to avoid or buy certain products, thus is in the centre of marketing communication for marketers to rethink their perspectives in formulating the design brief for a packaging product.

From an environmental stand point, packaging serves two aspects. First as an information material in the point of sales for consumers. An Abt Associates survey, found that:

> "the greatest number of consumers (52 percent of those who purchased an environmentally orientated product) learn about a product's environmental attributes from material printed on product packaging." [11]

And secondly the impact that it has on the environment as waste generated from the empty containers after use. As packaging generates a large source of waste, based on the resources used to create it, leading to our so called *'disposable society'*.[12] The packaging is the main targets of environmental and consumers groups, as well as recently by legislators regarding the minimisation targets on packaging and packaging waste. According to Wasik the:

> "packaging is the main target for environmental and public -interest groups when they choose to criticise a company's environmental record." [13]

Environmentally aware companies that want to give a responsible profile to the public should always examine the impact of their packaging waste. Companies have also to reflect the environmental qualities of the manufacturer, the seller and the product within the packaging chain.

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[10] Beaumont R, J; Pedersen M, L; Whitaker D, B, ((1993), 'Managing the Environment', Butteworth, UK, p 117
[11] Abt Associates, "Consumer Purchasing Behaviour and the Environment"
[12] Environmental issues related with packaging design discussed in details in chapter 5.
[13] Wasik F, J, (1996) 'Green Marketing & Management: A Global Perspective', Blackwell, USA, p 159

2.4 Misleading green marketing claims

It is ironic that while in 1990 the slogan *"environmentally friendly"* won the Green Con of the year award given by Birmingham Friends of the Earth for the most misleading green advertising of the year, we can witness todays' firms using it on their ads or on product information. Consumers surveys repetitively show that consumer awareness of environmental issues remains high - and consumers questioning business practices - a 'green' product placed in the market does not always raise the product's environmental credentials. Much of business activity is simply tokenism or cases of consumer misinformation. This typically involves meaningless claims.

In the publication 'Shades of Green' (1996) the National Consumer Council presented the findings from research that examined the variety of environmental claims on products. The research outcomes found claims to be *"unverifiable, vague, woolly, some even downright dishonest."*[14] In the report 'Green Claims' (1996) the National Consumer Council presents shoppers expressed scepticism about the truth of claims, confusion about what exactly was being claimed, and ignorance about their effect. The report presents findings that emphasise doubt about the validity of most environmental claims and calls for a new code of practice to ensure that consumers are given accurate and meaningful information.[15]

The Soap and Detergent Industry Association admitted that:

> *"many misleading claims are being made about the environmentally friendly nature of various Green products in order to attract the buying power of the Green Consumer".*[16]

Alan Wingrove (1998), Packaging Technology Manager at Tesco Stores found himself frustrated by the plethora of meaningless (and sometimes misleading) marketing terminology. He believes that there are too many accepted terms that extol the environmental credentials of a package that, upon closer consideration are unwarranted. He recommends that if there are any real 'green' virtues worthy of mention then the wording of these will also need to be '*clear, unambiguous, accreditable and credible'*.

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[14] National Consumer Council, 'Shades of Green - Consumers' attitudes to green shopping', December 1996: 3

[15] National Consumer Council, 'Green Claims: a consumer investigation into marketing claims about the environment', March 1996

[16] For an extent number of misleading environmental claims see paper 'Environmental Business Strategy: A new Model for Development?', reported ongoing Ph.D. research, presented at the international conference 'Whose Values? - Ethics in the International Business Environment', March 18-20 1996, , London. - A copy listed on the appendices.

Wingrove found that the problem that environmental labelling in packaging is facing is:

> 'the level of information that facilitates total unambiguity requires a volume of text that is simply not feasible within the space available'. And, he believes that 'a number of alternative solutions to the information issue will need to be found'.[17]

The research relates misleading 'green' claims based on their appearance, into two categories as follow:

⇒ ***The information gap*** - The proliferation in the market of the various unverified environmental claims, create an information gap. This information gap is defined by this research study as *the gap where there is not enough information available on assessing the products' environmental performance and safeguarding products stewardship towards the targets of sustainable development.*

For example, surveys conducted by Abt Associates and Green Market Alert[18] identified some of the more prevalent claims among household products. These are in order of greatest to least frequency:

1. Toxicity-related (42.9%). *Was the product poisonous or benign?*
2. Recyclable (13.9%). *Could it be recycled?*
3. Degradable (13.1%). *Did the product decompose in nature?*
4. Recycled (10.4%). *Did the product contain recycled content?*
5. General environment (10.3%). *Was the product environmentally safe?*
6. Pollution (4.1%). *Did it produce less pollution?*
7. Wildlife conservation (1.7%). *Did the product protect wildlife?*
8. Ozone related (1.4%). *Were there no ozone-depleting chemicals?*
9. Source-related (1.3%). *Was there less packaging materials?*
10. Energy (0.9%). *Did the product consume less energy?*

Most of these claims were found in products such as foods, health and beauty aids, beverages, pet supplies, cleaning products, and paper goods. Paradoxically, the most frequent claim was backed up by the least amount of independent verification. Conversely, the least-popular claims about ozone-related, source-related could be easily verified.

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[17] Alan Wingrove (April 1998) 'The truth....the whole truth?', Industry News column, 'Packaging News', p 4

[18] Source: Abt Associates, "Consumer Purchasing Behaviour and the Environment: Results of an Event-Based Study", November 1990

⇒ ***The credibility gap*** - The credibility gap related to products environmental information defined by this study as *the gap caused in the market because of products misleading environmental liabilities and uncontrolled environmental claims.*

The US Environmental Protection Agency (EPA) studies have indicated that the immediate issues of short-term economics (price) tend to override environmental concerns when consumers are faced with actual purchasing decisions. EPA report [19] indicates that the recent and rapid proliferation of marketing terms, combined with the lack of standardization definitions, may be exacerbating consumer confusion and scepticism. The report also, presents consumers who may want to do the right thing, but many do not feel that they can trust the sincerity of the environmental claims that companies are making.

2.5 The legislative background to the use of environmental information

Until now we examine the conceptual framework of business green communication, the role that the packaging plays as the 'green' medium in support of business philosophy and consumers environmental awareness and concern. In addition, cases of misleading environmental information on products and packaging have been given. Following this the backing of environmental claims by regulatory and legislative frameworks has to be considered. That includes the formulation of the eco-labelling schemes worldwide and the ISO 14000 series on environmental management systems.

Ecolabelling schemes

In order to control products environmental information many countries have established environmental labelling schemes. These schemes work to create standards for environmental improvements in various products, together with an accreditation scheme for products which reach those standards. The schemes co-ordination varies under the umbrella of governmental bodies, voluntary environmental organisations or and industrial bodies. The scope of ecolabelling schemes is to help control the provision of unverified and misleading environmental claims, while informing consumers about products that are less harmful to the environment compared with others similar products in the market. Ecolabelling schemes are communicated to consumer by the use of a label and/or wording on the product.

> "Ecolabel is a term used to describe an officially sanctioned scheme in which a product may be awarded an ecological label on the basis of its 'acceptable' level of environmental impact. The acceptable level of environmental impact may be

[19] US Environmental Protection Agency , "Status Report on the Use of Environmental Labels Worldwide", September 1993, EPA 742-R-9-93-001

> determined by consideration of a single environmental hurdle which is deemed to be particularly important, or after undertaking an assessment of its overall environmental impacts."[20]

Environmental labelling schemes rate products according to the impact of the product on the natural environment (from inputs to outputs), that means from the extraction of raw materials through the manufacturing process to the distribution of the product (transportation) consumption, product disposal and possibilities for after use. In the most comprehensive format eco-labelling schemes examine the environmental impact of the product in all stages (using Life Cycle Analysis, LCA methodology). Alternatively, due to the high cost of conducting LCA and the difficulties of finding appropriate information, some eco-labelling schemes award a label on the product by examining and assessing the most important environmental impact of the product (for example energy consumption; recycling context etc.) Some sort of environmental life cycle analysis used by some programmes to identify single attribute claims such as recycled content or biodegradability, or more frequently to assess the impact of the product in various stages, like the seal-of-approval programmes tend to follow for example the Blue Angel ecolabelling programme. Other programmes like Green Seal seek to establish a life-cycle inventory that assess how a single product will impact various environmental categories.

To date, ecolabels rate information under the following criteria:

1. **Single attribute** *(voluntary)* These programmes give an independent 'third party' certificate for a particular environmental claim made by the manufacturer, like for example, the percentage of recycled content, the energy use or the water saving.

2. **Seal-of-approval** *(voluntary)* Gives verification of claims for those products that are identified as being less harmful to the environment than others of the same kind.

3. **Information about hazard and disclosure labels** *(mandatory)* For disclosure labels specific environmentally related information about the product are provided, that information may compared with similar products (such as EPA's Fuel Economy Information label). Hazard and warning labels are mandatory concerning a product's adverse effect on health and safety issues.

4. **Books, Report cards & Life-cycle inventory studies** *(private environmental initiatives)* Information is provided to consumers about the product and often about the

[20] Extract from: Dooley, D. & Kirkparrick, N. (1993) Environmental Glossary. Pira International, Leatherhead, UK

company's environmental performance. This system uses comparison of attributes and lets consumers decide for themselves the influence of the product in the market.

At present ecolabelling is the only environmental multi-approach available (assessing the environmental impact of the product and packaging at the same time) compared with the existing OECD[21] and ISO approaches to assessing products environmental impact.

> "Environmental labelling programmes may represent such an exception, a voluntary economic instrument which promotes more environmentally friendly purchasing on the side of the public and a precautionary approach on the side of industry." Extract from OECD Report (1991)

The EU ecolabelling scheme was launched at the end of 1992 and is voluntary, self-financing and must not include food, drinks and pharmaceuticals. For companies the strength of the EU Eco-label is its European dimension. When one Member State approved it, the label can be used throughout the other States. This as a result avoids making an application in every country where a national label exists. It also avoids competition between different national labelling systems. The OJ (Official Journal) Council Regulation on a Community eco-label award scheme (23.4.1992) foretells that : *"Whereas a system to award an eco-label for products with reduced environmental impact will highlight more benign alternatives and therefore provide consumers and users with guidance;"*

Product groups which are using the EU Eco-label (flower logo) are washing machines, dishwashers, soil improvers, toilet paper, kitchen rolls, and laundry detergents. In February '96 three more products have adopted criteria for awarding the ecolabel - paints, varnishes and single-ended light bulbs despite expressing doubts about the criteria in November 1995. According to the criteria agreed, all cardboard packaging must contain a minimum of 65 per cent recycled material by weight. At the EU Packaging Report (1996) stated that these decisions have caused considerable concern in the packaging industry. Further, that the Commission's concerns are focused on the way products could secure the ecolabel even though some aspects were not environmentally benign.

Because social issues are intertwined with environmental concern (Wasik, 1996: 105) another approach to ecolabelling as a part of a broader rating system has been suggested. This approach involves the evaluation of a company's manufacturing processes and corporate behaviour. Such an approach is undertaken by the Asahi Shimbun Foundation in Japan and rates companies on the well-being of employees, environment, contributions to academic research, disclosure of corporate information and employment opportunities for

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[21] OECD: Organisation for Economic Co-operation and Development

non Japanese.[22] On the other hand, the US-based Council for Economic Priorities (CEP), rates multinationals on everything from arms production (a negative) to treatment of minorities and women (a positive).

These multivariable programmes give the public a much more comprehensive snapshot of a company's operations and performance. They might also 'simplify' consumers' requirements by knowing that they can trust a product that carries a label representing multi environmental and social criteria. But, on the other hand it should be considered that the information on pack might be too much for consumers, stakeholders and interested parties to consider. British Union for the Abolition of Vivisection (BUAV) and other animal rights organisations are deeply concerned that ecolabelling schemes like the EU ecolabel *'have drawn up a set of criteria which allows products that have been tested on animals to be eligible for ecolabel'*[23]. Although, animal testing is an important issue to be considered on products' development, the existing state of development of environmental labelling worldwide does not allow the possibility to include the examination of social criteria for example, animal welfare; workers rights; exploitation of workers in third world countries etc. Because the objectives of ecolabelling schemes worldwide are based on assessing and promote product because of their environmental benefits and supply information to consumers on environmental ground.[24]

In addition, as LCA methodologies are in a developing stage and relatively unfamiliar,[25] it would be more promising in achieving more substantial progress for products' LCAs, when ecolabelling schemes concentrated on just environmental criteria (as is happening) independently conducted and clearly stating the methodology used to award the environmental certificate (label). On the other hand, if some schemes include social criteria in awarding progress it might well be assumed by the consumer (resulting in more confusion) that all the environmental labelling schemes consider these kind of criteria - a possibility not pragmatic. In the context of eco-labelling schemes products environmental attributes are only examined, it might be more straight forward if only environmental criteria were to be considered (as is expected to happen) and allow other schemes to examine products and award labels on social issues.

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[22] Ibid.
[23] BUAV (April 1994) 'Ecolabelling and Animal testing', Factsheet, p. 1
[24] For example the objectives of the EU ecolabelling scheme are: 1)to promote the design, production, marketing and use of products which have a reduced environmental impact during their entire life cycle, and 2) to provide consumers with better information on the environmental impact of products (OJ L 99 of 11/04/1992, p. 1)
[25] The present state of LCA discussed in Chapter 1. Introduction

Environmental labelling and ISO 14000

ISO has recently started work on environmental management systems (ISO 14000 family) equivalent to EMAS (see 2.8.1). ISO has in the pipeline draft standards on environmental claims, including:

⇒ ISO 14020 on environmental labelling, which sets out the basic principles to be followed by all environmental labelling schemes;

⇒ ISO 14021 on self declaration environmental claims, which looks at manufacturers' and retailers' labels;

⇒ ISO 14022 which deals with symbols and logos;

⇒ ISO 14023 on testing and verification methodologies

⇒ ISO 14024 and ISO 14025 on guiding principles and procedures.

So far progress has only been made on the first two standards.

Environmental labelling the pros and cons

The advantage of labelling programmes should be acknowledged as their power to control and harness market forces and to support consumer preference in choosing on their behalf environmentally acceptable products and to give competitive advantage to companies that are using them. Although the advantages of labelling programmes' is worth while as a part of encouraging rational consumerism, it is of particular interest to study the disadvantages of a more holistic approach to the use of ecolabelling at international level.

Graedel and Allenby (1995) in the book *'Industrial Ecology'* found that between programmes the criteria for obtaining environmental labels for some products is more stringent than existing regulations and standards. At a stage when life-cycle assessment methods are relatively unfamiliar, labelling programmes give the promise of rapidly implementing LCA methodologies but, unless the criteria are carefully chosen, environmentally suboptimal performance may be encouraged.

While labelling programs definitely have their place in the move toward environmentally responsible products. It is clearly of little use to corporate or individual consumers to know that a product has received three labels and been denied two others, a circumstance possible today. Both the international nature of corporations and the imperfectly developed assessment situation give us reasons to argue for products that are carefully thought through and validated, and for those that are international in scope. Graedel & Allenby (1995) suggest that until those requirements are fulfilled, environmental labels for products are likely to contribute more to chaos than to rational consumerism.

Ritt Bjerregaard (1997), Environmental Commissioner (EU) sees the ecolabelling scheme as: *'an important market - orientated instrument in the EU's policy'*.[26] The effectiveness of environmental labelling schemes in terms of information provision as a part of environmental policy, has been questioned by Potter and Hinnells (1994), who found that:

> "'little thought appears to have been given to the effectiveness of labelling or how (it) integrates into other environmental policy.... As an isolated regulatory mechanism, even at its best labelling is relatively weak. A fully integrated environmental policy would combine information instruments, fiscal incentives, and minimum efficient standards'[27].

It has further be argued that market mechanisms, cannot deliver sustainable product consumption level.[28] In addition, even if it was the intention that the composition of a board developing Eco-label criteria *'is such to guarantee independence and neutrality'* (Ibid.), there is no guidance in the EU regulations as to how this requirements may be achieved. As a result industries are sceptical about the effectiveness of the scheme. Greenpeace complained that criteria are fixed to meet the needs of industry, rather than establishing environmental excellence.[29]

Corporations are driven by competitive pressures for market share to satisfy the labelling criteria. While, in practice industrial considerations happen to be dominated by what is technically achievable rather than what is the best possible benefit the environment.

"This could influence new product innovation strategies, and particularly the commercial development of environmentally - benign technologies." comments Mark Smith in the book 'ISO 14001 and Beyond' (1997, p. 99). In addition he views small firms in general to be more innovative than larger companies. But, large companies are leading the market and can rapidly bring effective changes through the diffusion of incremental improvements to existing designs.

For a successful labelling system, experience to date shows that:

⇒ There must be a high level of environmental concern among the market where labels are used. The high level of environmental interest proved crucial to the growth of German labelling programme, Blue Angel.

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[26] Bjerregaard R, (April 1997), comment on the UK Ecolabelling Board Newsletter, No. 11, p 2
[27] Potter, S and Hinnells, M (1994), '*Whither the EC-Label? An analysis of the development of eco and energy labelling in the European Union*', Technology Analysis and Strategic management
[28] See: Brundtland, G (1987), World Commission on Environment and Development: Our Common Future, Oxford University Press, London and Meadows, D and Randers, J (1992) Beyond the Limits: Global Collapse or a Sustainable Future, Earthscan, London
[29] See West K, 'Ecolabels: The Industrialisation of Environmental Standards', in The Ecologist, Vol. 25 No. 1 (January/February 1995)

⇒ The credibility and acceptance of any environmental label scheme must stem from criteria chosen for basis of environmental legislation, direct regulations and governmental plan to protect the environment.

⇒ The criteria should be established as a result of Life Cycle Analysis (LCA) and other related feasibility studies assessing products environmental impact. At the same time comparative studies about the environmental impact of other products of the same kind should be consulted.

⇒ The award of the label for a product should be a part of the decision-making process for an organisation considering the different stages of addressing the environmental analysis and geared by the existing legislation.

2.6 Life Cycle Analysis and Assessment methodology

Life Cycle Analysis attempts to assess the resource cost and environmental implications of different patterns of human behaviour. Introduced during the late 1960s and early 1970s and taking form in the 1990s, life cycle analysis and assessment (LCAs) become global modelling studies and energy audits aiming to explore the potential of environmental decision makers. The concept of conducting a detailed examination of the environmental impact of the life cycle of a product or a process is relatively recent, says The World Resource Foundation (August 1995). The most commonly used definition of LCA methodology is from the Society of Environmental Toxicology and Chemistry - the same definition of the LCA process is also given by Fava, 1991: 19; Gray, 1993: 165; Graedel and Allenby, 1995: 108; The World Resource Foundation, Information sheet on LCAs, August 1995 - and is as follows:

> The life-cycle assessment is an objective process used to evaluate the environmental burdens associated with a product, or activity by identifying and quantifying energy and material usage and environmental releases. The data then used to assess the impact of those energy and material releases on the environment, and to evaluate and implement opportunities to achieve environmental improvements. The assessment includes the entire life cycle of the product, process or activity, encompassing, extracting and processing of raw materials; manufacturing, transportation and distribution; use/re-use/maintenance; recycling and final disposal.

A number of different terms have been coined to describe 'life cycle analysis' and 'assessment' (LCA) - such terminology with similar meaning includes: cradle-to-grave analysis/assessment or material flow analysis or resource analysis; eco-balance assessment or eco profile; environmental impact analysis/assessment (EIA).

Although the intention or the purpose of these studies can be the same, as far as packaging is concerned, each aspect can be defined differently by principle. According to Lox (1992: 243), *"ecobalances can be regarded as the evaluation of the environmental impact of each process, part of the whole subsequent series of handlings by which packages are made and treated".*[30] For example ecobalance considers aspects related to energy production, the production of materials, transportation, distribution, waste treatment. Ecobalances can be expressed as the energy consumed in Milli Joules, the materials required and the emissions produced per unit of packaging material in kg or delivered number of packages per thousand. Lox (1992: 243) see that: *'the life-cycle analysis can be regarded as the summation of all ecobalances encountered in the material flow to produce packages and their waste treatment."*[31] Ecobalances and life-cycle analysis/assessment are mainly based on the same principles upon considerations of the consumption of materials and energy and the associated production of materials and waste.

The environmental impact analysis/assessment (EIA) defined by Fuller (1992: 12) as: *"essentially a process that seeks to identify and predict the impacts of a new developments on the environment, to mitigate them where possible and to monitor the actual impacts".*[32]

While, the Institute of Packaging and the Environment states that:

> "the main purpose of an LCA is to identify where improvements can be made to reduce the environmental impact of a product or process in terms of energy and raw materials used and wastes produced. It can also be used to guide the development of new products". (INCPEN, 1996;)

From the literature review only INCPEN distinguish a difference between life cycle analysis and life cycle assessment. The difference indicates that analysis is the collection of data that produces an inventory; and, assessment goes one stage further and adds on an evaluation of the inventory. According to INCPEN (1996;) a 'life-cycle analysis' does not define or explain actual environmental effect. For example, an LCA gives how many grams of limestone are used to make a bottle for mineral water and how much energy was used to extract it. But it does not tell the environmental impact of this action, such as whether limestone is a scare resource or whether its extraction causes pollution. LCA gives information about for example the amount (grams) of liquid, solid or gaseous waste are

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[30] Lox, F (1992) Packaging and Ecology, Pira International, p. 243
[31] Ibid.
[32] See also the EC Directive on Environmental Assessment (85/337); Ball and Bell (1991); Institute of Environmental Impact Assessment (EIA, 1990); ENDS Report 195/ April 1991, pp. 15-17; Gray and Symon (1992a); The Environmental Assessment Report No. 2 Winter 1991, p 3; and Gray, 1993 pp. 79 - 83.

produced but not what happens to it. The life cycle assessment is considered as the next stage because it gives information for example, about what happens to particular waste.[33]

Although it can be identified that there are some differences between life cycle analysis and assessment, this study considers them in very similar view. The literature review[34] reveals that life cycle analysis and assessment, are the same. Also, during discussion with UKEB Eco-Labelling Board they expressed the same opinion - that life cycle analysis and assessment studies are the same.[35] This study considers as 'life-cycle' the stages of a product, process, or package's life, beginning with the product concept (and given design brief); the raw materials acquisition; continuing through processing requirements and specifications; materials manufactured, product and packaging fabrication; product and packaging use; and concluding with any of a variety of waste-management options.

The life cycle assessment (LCA) is viewed by this research study as a concept and a methodology which provides (by the use of life cycle analysis) data for environmental impact analysis and evaluates the environmental effects of a product or activity holistically, by analysing the entire life cycle of a particular material, process, product, technology, service or activity. The collection of the data about a product or packaging system is on a *'cradle-to-grave'* basis, thus including all inputs and outputs in terms of energy and material, through manufacturing process, distribution, use, possible reuse or recycling and eventually disposal.

LCAs can be used to define the present (considering existing technology progress and legislation requirements) environmental impact areas of a packaging line. Towards *'sustainability'* a further evaluation was required (see eco-audits in the section below) to compare and assess different available options towards environmental improvements.

The formal structure of LCA contains three stages (for the following definitions see Gray, 1993:168) Graedel and Allenby (1995: 108-110) who see these stages as the scoping of the LCA:

1. **Life Cycle Inventory** is the review of the product, identification and description of all resources, emissions, discharges and disposals throughout the cradle to grave of the product.

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[33] See in particular The World Resource Foundation, Warmer Bulletin, August 1995; Gray R, 1993:164-176; While US EPA, 1993; SETAC, 1993; and Dewberry, Design Innovation Group, The Open University, 1994 - present first the development of life cycle analysis in the early 1970's and more recently the life cycle assessment defined both of them as giving the same evaluation.

[35] Personal Correspondence: Interview with Paul Jackson, Principal Scientist (Technical assessment of applications; compliance monitoring; development of criteria), UK Eco-labelling Board, February 1997

2. **Life Cycle Impact Analysis** is the identification, possible quantification and assessment of the human and other ecological impacts of the elements identified in the inventory stage.
3. **Life Cycle Improvement Analysis** are attempts to reduce, ameliorate or eliminate the impacts through various means including redesign of products and process.

The above stages of LCA are relatively self-explanatory, without being simple or uncontroversial. For packaging businesses to use the above 'scoping' of the LCA and accurately assess the impact of a packaging products' and manufacturing process involves the following activities in each LCA stage:

1. At the 'life cycle inventory' stage quantitative data collected to establish the levels and types of energy and materials inputs to the industrial system and the environmental release of the system. In that stage potential liabilities are considered and addressed. The assessment is done over the entire life cycle - material extraction, manufacture, distribution, use and disposal. The analysis of the results indicate the environmental impact areas that may be affected by the companys' operation and production system.

2. The 'life cycle impact analysis' stage involves considerations relating to the outputs of the system (companys' operation product and packaging) on the external world into which those outputs flow and consumption of goods are made.

3. At the 'life cycle improvements analysis' stage is the interpretation of the data collected on the above two stages of LCA - aiming to identify business areas where environmental improvements are required. The 'life cycle improvements analysis' is the most important stage for managing design improvements. Designers should concentrate on the most important environmental problems, reserve for later those that produce lesser impacts.

An environmental LCA for packaging is a means of quantifying how much energy and raw material are used and how much (solid, liquid and gaseous) waste are generated at each stage of a product's life. According to INCPEN (1996;) data needs to be collected from all stages of the following: obtaining the resources; production; distribution; use; disposal.

2.7 Environmental auditing

PIRAs' International (formerly Paper Industry Research Association) approach to LCA is that: 'LCA is "*first and foremost a management technique that serves to quantify the environmental impacts associated with a given product, process or activity*". In addition

Pira see LCA as assisting organisations to improve their current environmental performance and help them to gain a market advantage over competitors.[36] Further LCA has significant input on giving an environmental analysis/assessment for products and packaging by combining LCA findings in a broader evaluation system related to the organisations' environmental performance and activities; such analysis provided by the ecological (or environmental) auditing. Ledgerwood (1992: 75) compares the environmental audit with the environmental assessment. He found that environmental audit concerns the existing operation of a firm and, in contrast the environmental assessment focuses on the impacts of future proposed developments on the environment.[37]

Environmental audits and reviews are related to company compliance with legislation and regulatory codes; assistance in acquisition and disposal valuations; and lead corporate development towards green missions. Ecological auditing helps managers and design managers in meeting the challenges of environmental responsibilities by integrating environmental criteria for a company corporate investment.[38] Environmental auditing is a new generic term used to provide the evaluation of company environmental performance. It is based on principles similar to accounting, law, engineering and management and provides a link between company policy, management practice and technology.

A definition of 'environmental audit' is given by the Confederation of British Industry (1990) as:

> "the systematic examination of the interactions between any business operation and its surroundings. This includes all emissions to air, land and water; legal constraints; the effects on the neighbouring community, landscape and ecology; and the public's perception of the operating company in the local area..... Environmental auditing does not stop at compliance with legislation. Nor is it a 'green-washing' public relation exercise... Rather it is a total strategic approach to the organisation's activities".[39]

The process of environmental auditing is a matter of both complexity and importance. In Europe it is under development at National European Government levels, the 'eco-audit'

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[36] Personal Communication with The Environmental Unit of Pira International, March 1996. - Pira International is a UK based leading independent centre for research, counsultancy, training and information service for the paper and board, packaging, printing and publishing industries.
[37] Ledgerwood, G. (1992) Financial Times 'The Environmental Audit and Business Strategy - A total quality approach', Pitman Publishing, p 78
[38] See Referred Paper of this research study : 'Environmental auditing for products market acceptability', presented - at the '1996 Business Strategy and the Environment Conference', 19th Sept. 1996, University of Leeds, UK - a copy is attached on the appendices.
[39] The Confederation of British Industry (1990), Narrowing the Gap: Environmental Auditing Guidelines for Business, London (CBI) - Note: this definition is based upon The International Chamber of Commerce Environmental Auditing (1988), Paris (ICC) definition.

and 'eco-labelling' regulations, potential land reclamation liability, suppliers audit, the BS7750 and ISO 14001 on environmental management, compatible with the EC's Eco - Management and Audit Scheme, (EMAS). The environmental audit which is also called 'review', 'monitoring', 'surveillance' or even 'quality control', is covering a variety of management practices towards the assessment and evaluation of organisation's environmental performance (see for information on environmental management systems below).

The types of environmental audit include: environmental impact assessment; environmental survey; environmental review, monitor and surveillance; environmental investigation; the 'eco-audit' BS7750 and ISO 14001 towards environmental management systems; and independent attestation of environmental information - for internal or external participants. There are many types of environmental audits, depending on the type of business being audited, the reason for the audit and the depth and breadth of the audit. Environmental audits include audits which are carried out to improve energy and resource conservation - production audits; corporate audits, which consider the environmental performance of the entire corporation; site audits, which consider a single installation unit; waste management audits working for reduction or recycling process; safety audits to identify hazards and quantify risk assessment; disposal audits to assess past, present or future liabilities; compliance audits to verify whether the company is complying with existing environmental legislation and standards; suppliers audits to measure suppliers environmental performance; occupational health and safety audits; quality control audits;

The implications for environmental auditing for packaging design

According to the Industry Council for Packaging and the Environment (INCPEN) *'Packaging Policy Options: Discussion Paper'* (1993), any serious ecological audit should include a 'cradle-to-grave' assessment of the environmental impact of the goods concerned, examining everything from the original winning of the raw material to the final disposal of the product after use. The audit should include the consumption of raw materials, the energy required for manufacture, distribution and perhaps even the use of the product, the pollution of air, water and soil through emissions and discharges, and the final disposal of the waste once the goods have been finished with.

The Institute of Packaging and the Environment (INCPEN) in its factsheet (1996;) about life-cycle analysis, states that:

> *"the main area where the negative impact of packaging can be reduced is at the design stage so that the packaging is a balanced combination of function and environmental impact"*. A design audit may be used to address these issues.

Oakley (1990: 325) sees *'design audits* (in general) serve much the same purpose as financial audits - basically'.[40] Cooper and Press (1995: 198) argue that design audits *suffer from the same problems as any other audit; that is, how does one define the boundaries of a design audit, what are the criteria for assessment, how should it be implemented and by whom?*[41] Cooper and Press (1995: 199) identify that:

> "design audits in a more general sense have not been developed to any great degree or, indeed, in any manner of consistency".

General checklists on design and business *'best practice'* are available for instance, from the Design Council that has in conjunction with the Department of Trade and Industry (DTI, UK), published a large number of documents addressing aspects of design management. Many of these checklists address issues that can be a basis on which audit could be developed. Cooper and Press (1995: 199) note that *'auditing design is rarely mentioned* (in most texts), *except for minor reference in strategic audits'*. They found as the most common reference to audit among the design profession to be the *'communication audit'* - as related to corporate identities. Further they indicate that most corporate identity designers consider it important to understand the company at a number of levels: firstly, to understand the corporate philosophy and strategy; secondly, to understand .how the company operates, and finally, to understand how it communicates and to whom. Kotler and Rath, urge marketers to assess corporate design sensitivity and measure design management effectiveness. In their audit, they used five questions for each topic and, scoring the answers, providing the company with an overall design sensitivity and design effectiveness rating.[42] The Council for National Academic Awards have made recommendations that an 'audit' of design activities might involve:

> "assessing the results achieved in the past and the present capabilities of the design department...strategic planners must review conditions in the market place and the overall business environment, as well as particular firm. The analysis must not concentrate on present events only; predictions are essential to ensure that future

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[40] Oakley, M. (1990) Design Management - A handbook of issues & methods, Basil Blackwll Ltd, UK, p 327
[41] For Design Audits, see: Cooper, R. and Press, M. (1995) The Design Agenda - A Guide to Successful Design Management, John Wiley and Sons Ltd, UK, pp. 198 - 221
[42] Kotler, P. And Rath, G.A. (1990) Design: A powerful but neglected strategic tool, Journal of Business Strategy, 5(2)

> work will be compatible with attitudes and perceptions prevailing at the time of the launch".[43]

In comparison, Topalian's approach to audits is much more comprehensive, suggesting that corporate design audits '*denote the formal and comprehensive examination of what goes on design wise within industrial and commercial organisations*'.[44]

A more rigorous approach to design audits - addressing quality and environmental audits - is used by The Design Council[45]. The Design Council Design Audits takes the three levels used by BS 7750 - corporate level, project level and design activity level - and five topics: objectives, planning, communications, implementation and evaluation. Using methodologies arising from other measurement activities such as job assessment, questions are developed for each level and topic (e.g. for the corporate management the question is: *Are the company's objectives clear?*), with answers scored on a scale of *a* to *e*, where *a* represents a clearly unacceptable situation and *e* is the ideal; *c* is usually the minimum acceptable standards of achievement. The audit process entails a trained professional carrying out a design audit throughout a company using the audit questionnaire. The final audit report includes statements relevant to each question and scale with accompanying comments from the auditor. This tool aims to identify key issues, and the most important variables in the standards of managing product design at every level. Design councils throughout Europe have implemented less structured approaches than the UK Design Council in design audits, with the aim of assessing the effectiveness of firm's existing use of design, and to make recommendations for improvements. There are initiatives by European design councils working with industrial sectors in order to develop consistent European design audits (Cooper and Press, 1995: 209).

There are emerging pressures for packaging design to be audited as for example, environmental legislation on packaging and packaging waste placing responsibilities in the packaging business to deal with their packaging waste generated from primary; tertiary and transport packaging. There are also a number of environmental areas affected by packaging production. And, many decisions affecting the environmental impact of a packaging are taken during its design and development stage - for example, about the use of materials.

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[43] CNAA (1984) Managing Design: An Initiative in Management Education, Council for National Academic Awards, London
[44] Topalian, A. (1983) Summary Notes on Corporate Design Audits, Alto Design Management
[45] In particular in the audit developed by Mill Morton as Director as Director of the Design Council for the North of England,

2.8 Environmental Management Systems

To assist design managers in formulating design concepts; planning the product development; controlling the whole process and implementing environmental orientated products and packaging, a strategic approach to dealing with environmental improvements should be adopted. To manage this an investigation should be carried out into the environmental mechanisms of companies and their effects on the final product and packaging. 'Environmental mechanisms' is defined by the UK Round Table on Sustainable Development (First Annual Report, April 1996, p 8) as including environmental management and environmental audit.

Many organisations are actively engaged in using and developing Environmental Management Systems (EMSs). The UK Round Table on Sustainable Development, First Annual Report (April 1996: 39) identifies that *"in the last few years, there has been increased interest in environmental management"*. Godman (1997: 40) of DNV Quality Assurance Ltd, commented in *The EIC[46] Guide to the UK Environmental Industry 1997*, that:

> "environmental management is increasingly being recognised as a desirable, even necessary, part of good business management".

Much environmental management advice has been published. There are currently three formal specifications for EMS available in UK and Europe, that help organisations to provide a systematic framework for assessing their environmental performance:

1. the launch of the EU Eco-Management and Audit Scheme (EMAS) in April 1995,
2. the introduction in 1992, and revision in 1994, of British Standards (BS) 7750 and,
3. the 1996 the International Standards (ISO) 14001.

Participation in the above schemes is voluntary. EMS specifications exist at National, European and International levels and it is for each organisation to decide which one best describes and suits its particular needs (EMS specifications provided below). Once an EMS has been developed, the decision is often taken to go for certification for ISO 14001 and/or BS7750, or for verification with EMAS. EMAS is primarily a registration scheme for industrial and manufacturing sites, although it has also been extended, in the UK, to local authorities. While, BS 7750 and ISO 14000 are open to all sectors and to the whole organisation or to units within an organisation.

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[46] EIC stands for The Environmental Industries Commission

Environmental Management and Audit Scheme - EMAS

EMAS[47] is a European Community initiative implemented by Council Regulation (EEC) No. 1836/93 of 29 June 1993. The Regulation required that all EC member states were to implement a scheme according to the requirements specified by January 1996. In the UK the system for accreditation and supervision of Verifiers came into being in April 1995.

According to the Department of the Environment, UK Competent Body (EC EMAS, *An introductory guide to industry*, April 1997) EMAS has been established to improve the quality of environmental management throughout European industry, to help companies to gain a competitive advantage from these improvements, and to communicate their progress to the general public. EMAS it is designed to provide recognition for those companies who have established a programme of positive action to protect the environment, and who seek continuously to improve their performance in this respect. A company registered with EMAS should have clearly defined strategy for environmental management, complete with quantified objectives.[48]

EMAS requires from participant companies who apply for registration to implement the following stages at the relevant site:

1) ***Environmental Policy:*** the central elements of the policy are: compliance with relevant environmental regulations and a commitment to continuous improvements;
2) ***Environmental Review:*** is a comprehensive analysis of the inputs (include energy management, raw materials management, waste avoidance, evaluation of noise control and current accident procedures), process and outputs at the site to identify the relevant environmental impacts and issues for management;
3) ***Environmental Programme:*** set out in accordance with the policy and review, contains specific goals for the site and describes the means to reach these objectives;
4) ***Environmental Management System*** - establish operating procedures and controls to ensure the successful implementation of the environmental policy and programme: it involves the organizational structure and people appointed to perform the new responsibilities;
5) ***Environmental audit cycle*** - environmental practices and performance are checked against the stated policy, specific goals, and relevant regulations and standards;
6) ***Environmental statement*** - companies required to prepare a concise and comprehensive statement for the public, for each participant site ;
7) ***Validation*** - the environmental statement must be validated by an accredited independent environmental verifier also, the policy, programme, management system and audit procedure have to verified as comforming with the requirements of the scheme. Sites that are already using a standard for environmental management systems avoid the certification with EMAS, but the verifier has to recheck their management system.

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[47] The Department of the Environment, Transport and the Regions in UK to help small size enterprizes to establish an environmental management system and to register under the EMAS is granted a scheme called SCEEMAS: Small Company Environmental and Energy Management Assistance Scheme.
[48] Information provided from personal communication with Department of the Environment, UK Competent Body, of EMAS, 1997;1998.

ISO and BS standards on environmental management systems

The UK 'Environmental Management Systems' standards BS 7750 came into effect in January 1994 with initial implementation via a 'pilot' scheme. The initial group of Certification Bodies accredited in March 1995. BS 7750 does not set out environmental performance guidelines, since it recognises that every business is different, the impact it has on the environment and the amount by which each organisation can improve environmental performance will vary. Nevertheless, BS believes that every business can achieve something and compliance to environmental performance standards is critical to business success in many organisations.[49] BS 7750 requires from business: a preparatory review; an environmental policy; clearly defined responsibility; up-to-date records of relevant legislation relating with business activities; a 'register of significant effects'; an environmental management manual; records of the progress towards meeting the objectives; regular internal management audits.

The ISO 14001: 1996 *'Environmental Management Systems - Specification with Guidance for Use'* developed by the International Organisation for Standardisation (ISO) is based around the same principle of BS 7750. The ISO 14001 was formally issued on 1st September 1996 and replaced the BS on *'Environmental Management Systems'* on 31st March 1997. All Certification Bodies which were accredited for BS 7750 were automatically accredited for ISO 14001:1996, and those already certified to BS 7750 will need to convert to the new international standard.

The coming on stream of ISO adds another dimension to the field of EMS - internationalisation. The Institute of Environmental Management (IEM: 1996) states that: *"never before has there been a tool promoting systematic environmental management across the globe".*[50] ISO 14001 specifies the requirements for an environmental management system against which an organisation may be certified by a third party[51], including:

- ⇒ the development of an environmental policy;
- ⇒ identification of environmental aspects;
- ⇒ establishment of relevant legal and regulatory requirements;

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[49] Personal communication with BS Information Service (1996; 1997). Information obtained about Introducing Registration to BS 7750.
[50] IEM (1996), 'ISO 14001: Looking beyond bureaucracy', Institute of Environmental Management Journal, Vol. 4, Is. 2, p 14
[51] It is also possible for organisations to make a self-declaration of compliance to the requirements of the standard.- Source Sheldon, C. (1997) ISO 14001 and Beyond, Environmental Management Systems in the real world, GreenleafPublishing, p 44

⇒ development of environmental objectives and targets;

⇒ establishment and maintenance of an environmental programme in order to achieve its objectives and targets;

⇒ implementation of an EMS, including training, documentation, operational control and emergency preparedness and response.

⇒ monitoring and measurement of operational activities, including record-keeping.

⇒ EMS audit procedures;

⇒ management review of an EMS to determine its continuing suitability, adequacy and effectiveness.[52]

ISO 14001: 1996 requires that an organisation identifies the:

> *"environmental aspects of its activities, products or services that it can control and over which it can be expected to have an influence, in order to determine those which have or can have significant impacts on the environment"*(Clause 4.3.1).

An environmental *aspect* is defined in ISO 14001: 1996 as any *"element of an organisation's activities, products or services that can interact with the environment"* (Clause 3.3). An environmental impact is defined as "*any change to the environment, whether adverse of beneficial, wholly or partially resulting from an organisation's activities, products or services"*(Clause 3.4).

Activities (products or services) generally have one or more environmental aspect associated with them. For example a painting process might result in release of Volatile Organic Compounds (VOCs) or release of particulates. Each aspect in turn may result in one or more environmental impacts - actual changes in the environment. VOC release, for example, contributes to the formation of photochemical smog and depletion of the ozone layer. ISO 14001, clarifies the situation in many ways by introducing the concept of an aspect between the activity and an impact. Under BS 7750 the term effect (which is broadly analogous to impact) was often a source of confusion with many managers blurring the difference between aspects and impacts thereby failing to define properly the impact of their organisation's activities[53]. The ISO standard provides a series of associated standards related to and providing guidance on various environmental issues, including auditing, qualification criteria, environmental labelling and life-cycle assessment (LCA).

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[52] Annex A of ISO 14001: 1996 contains additional guidance on the use of the requirements and is intended to avoid misinterpretation of the specification; while Annex B contains information on the linkages and broad technical correspondences between ISO 14001 and ISO 9001, Quality Systems: Model for Quality Assurance in Design, Development, Production and Servicing - the equivalent Quality Management Systems standard.

[53] IEM (1996), ISO 14001: Looking beyond bureaucracy, Institute of Environmental Management Journal, Vol. 4, Is. 2, p23

Environmental management systems - Comparisons and specifications

EMAS and Standards are not competitive but complementary approaches to the same end. Companies can use environmental standards as the basis for their environmental management system from which they can progress to EMAS registration or optionally to go straight to EMAS from the outset. In basic terms, both Environmental Management Standards and EMAS require an organisation or site to have:

- ⇒ An 'Environmental Policy' stating the intention and principles of the organisation in relation to its overall environmental performance.
- ⇒ The environmental policy which sets objectives and targets defining broad environmental goals and more detailed performance requirements;
- ⇒ A sound understanding of environmental impact (areas) as defined by ISO 14001 or effects defined by BS 7750;
- ⇒ An environmental management system in place;
- ⇒ Use of appropriate control procedures for activities;
- ⇒ Internal audits of the EMS;
- ⇒ Management review.
- ⇒ Publicity of environmental activities.

In particular, BS 7750 requires the environmental objectives to be made publicly available and ISO 14001 requires as well to make information available to the public related to the Environmental Policy. EMAS requires in addition the preparation of an 'Environmental Statement' publicly available, based on a preparatory environmental review. For formal registration to EMAS, verification of the Environmental Statement' is required by an accredited verifier.

The EC agreed in March 1997 that ISO 14001 meets the management system requirements of EMAS.[54] Even though ISO 14001 and BS 7750 can apply to any organisation, in any sector and EMAS applies only to individual sites - ISO 14001 (and BS 7750) have compatibility with EMAS. If a site has been certified to standards, the basic EMS will also satisfy the corresponding requirements of EMAS. The major difference between them is that EMAS additionally requires companies to publicly report their performance (Environmental Statement) and have that statement independently validated.

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[54]In the beginning the ISO 14001 did not fully met the EMS requirements of EMAS, but the EC produced a document called the 'Bridging Document' that addressed these differences. At present ISO 14001 and EMAS are compatible.

The BS 7750: 1994 refers to *'environmental effects'* whilst ISO 14001: 1996 refers to *'environmental·impacts'* These phrases are equivalent and in addition, ISO 14001: 1996 identifies *"significant environmental aspects which has or can have a significant environmental impact"*. Environmental Management Systems specifications have in common that they were formulated on the basis of the logic of good environmental management practices and lead towards methods that control and substantiate environmental improvements.

2.9 Environmental indicators for paper packaging industry

Until now the methodology for environmental assessment, LCA, eco-audits, design audits and environmental management systems have been examined. In this section the environmental properties of paper based packaging are evaluated in terms of construction and design in order to combine such findings later on in the research process, when developing assessment methodologies for packaging.

Paper is made from cellulose fibre, the source of which can be pulped wood, or a variety of other materials such as rags, cotton, grasses, sugar cane, straw or waste paper. Paper packaging is light weight, but not as light as plastic (that is why a lot of paperboard packaging in the food sector - paper cartons - are replaced by plastic packs), has high rigidly and it is easy to handle and carry. It is suitable for automatic high speed packing lines. And, when using cartons it is easy and economical to change product lines.

In relation to design paper and board material offer flexibility in use and a wide range of choices in weights and different surfaces. Paper and board packaging are delivered flat for filling and when filled can make maximum use of storage space. It offers good printability on flat surfaces and ideal opportunities for branding. Also, it is appropriate to make in small quantities for market testing or special promotion, because it is inexpensive compared with other packaging media.

There are many new products which contain non-paper ingredients: laminates, hydrocarbon films and synthetics fibres, making paper hard to recycle. Another problem for paper and board is created by latex adhesive particles, which, when recycled, adversely affect paper quality and printability. Corrugated boxes have total recyclability and are easy to separate from other kinds of paper. Hand - crafted papers, made from recycled or plant materials, give opportunities for packaging design, but require extra attention in printing.

Paper is a useful and versatile material, but unfortunately, its manufacture not only consumes large quantities of resources, but also contributes to environmental pollution.

A number of environmental issues related to the paper industry are described in the headings below.

Environmental concerns in the paper industry

Energy: For most mills energy costs are the second or third most important item after the cost of raw materials and have rightly been the focus of attention throughout the industry's history. Recent improvements in technology and better management of the manufacture process have resulted in significant economies. Over the past ten years energy consumption per tonne has fallen by more than a fifth. Further gains at a general level are going to be more difficult to win but there is clearly room for improvement at the individual mill and machine level. According to the Energy Efficiency best practice programme (1997) from the Department of the Environment '*the key to energy efficient is management...it is often easier to increase profitability of a company by reducing energy costs than by increasing sales or turnover.*'

Water: Of all environmental issues, water has perhaps become the most emotive subject. For the production of every tonne of paper, the chemical processing needs between 100,000 and 300,000 litters of water. In 1986 major improvements were made to the waste water treatment plant. Central to this plant was aerobic and non-aerobic treatment designed to reduce solids and biological oxygen demand. Improvements in 1992 were dramatic: solids were reduced by a factor of 10 and BOD by a factor of 20. Also, existing technology by improved the industrial processes enable much of this water to be recycled.

Pollution: The pollution of paper and board comes mainly from the bleaching process, used to whiten paper and are then discharged as effluent into rivers. Traces of dioxins have been found in paper products and the possible effects on river and marine wildlife of the chlorine bleaching process have been causing concern for some time. The drawbacks of producing paper from virgin woodpulp have been recognised, and savings which could be made, if waste paper were to replace virgin pulp have been identified. By using recycled fibres it can be decrease air pollution by 74% and water pollution by 35%. Recycling also reduce water use by 58% and energy use by 40%.

Recycling: The EU Packaging Directive define recycling (recycle) as *"to reprocess waste materials in a production process for the original purpose or for other purposes including composting but excluding energy recovery"*[55]. The major economic advantage of recycling is in reducing the need to use imported pulp. Paper collection can be complicated because

[55] EU amended proposal for a Council Directive on packaging and packaging waste, 22nd December 1993

wastepaper has over 600 grades classified under these categories: groundwood (newsprint and cardboard); groundwood-free; coated/uncoated; white/coloured; and printed/unprinted. Paper mills can accept only certain grades of waste in order to produce fairly uniform stock.

Recycled paper ***(Materials Recovery or Recycling or Reclamation)*** - The Warmer Campaign (1991), defined recycled paper as *"papers whose fibre content is at least 50% waste paper, excluding mill broke"*. Another states that any recycled paper or board must be made from a minimum of 75% recycled fibre excluding mill broke[56]. Manufacturers needed to declare the proportion and source of recycled fibre used in any product. But, international co-ordination and agreement are clearly needed.

Obstacles on paper recycling - There are some drawbacks with recycling waste paper and board, especially printed waste. De-inking is an expensive process used to remove the ink from the resultant pulp when it is incorporated into white paper or board to be used for printing. Untreated printed waste produces a discoloured grey/brown pulp which can be used in certain packaging and bookbinding boards.

Contaminants like sticky address labels, non-water soluble glue bindings, plastic envelope windows, handles, hinges, also coatings with wax and plastic are not recyclable. Paper with special print process like UV (impossible to remove from the paper) coatings and foil stamping cannot be recycled. Also difficult to recycle is paper printed with laser ink or copy machine tonner. Since the ink is difficult to remove, the pulp made from this waste is often used in products such as hand towels.

Paper cannot be recycled ad infinitum. The wood fibres can only be recycled three to six times. After that they are so short that they are no longer suitable for paper production.

Advantages on paper recycling - There is a great public preference for using recycled paper.[57] Each tonne of recycled paper produced saves approximately 17 trees (this is of particular importance for countries like Britain that import virgin fibres), reduces landfills by three cubic yards, requires approximately 4,102 kilowatt-hours less energy than virgin paper, reduces air pollution emissions by 60 pounds per tonne of paper produced and requires 7,000 less gallons of water per tonne compared to non-recycled paper (Data from Earth Care Paper: 1997).

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[56] Warmer Factsheet (1991), 'Paper Recycling', UK, 2
[57] See: Mikulski J., (1995) *Recycledprinting and writing Papers: A growing market.* published in 'The HMSO Register of Recycled Paper and Paper Products, UK, p. 11. and, Pulp and Paper Information Centre (1997) PaperFocus Environmental Report, p. 3

Bleaching: Environmentally conscious buyers are asking for unbleached papers because of the effect on the environment. In addition, more paper mills are learning about bleach substitutes or less harmful bleaching methods such as oxygenated bleaching systems used in some mills. Pressure is being brought on paper manufacturers by environmental groups such as Greenpeace and Women's Environmental Network to introduce labelling which will show chlorine levels in paper products. They oppose the use of chlorine bleaching agents in paper manufacture, asserting that other - less harmful - bleaching methods exist. Paper characteristic according to the bleaching method are as follow:

⇒ **Totally Chlorine Free (TCF)** paper is produced from cellulose that is bleached without the use of chlorine chemicals.

⇒ **Paper with traces of chlorine** - is produced from cellulose that is bleached with chlorine compounds instead of elemental chlorine.

⇒ **Elemental Chlorine Free (ECF)** - this pulp is bleached without the use of chlorine gas. However some chlorine dioxide is used, plus other non chlorine based products such as Oxygen.

Biodegradability: Paper and generated cellulose film, is a biodegradable material, because it can be consumed by micro-organism and can be converted to carbon dioxide, water and biomass. Biodegradable paper at present is not a realistic alternative because, it gives limited protection to a product and is often coated with substances to make it resistant to decomposition In addition wax or plastic coatings will hinder or slow paper's degradation rate still further. In general any combination of paper with other materials make paper to remain into landfills over many decades. However, as biodegradability is one answer to the problem of reducing packaging waste and litter, technology should exploit biodegradable features of materials.

Sustainable management forest: The raw material for making paper is predominately trees[58], and it takes on average one tree to produce 15,000 sheets of A4 paper. The wood[59] for paper making is produced by trees that are grown and harvested as a long term crop with new trees planned to replace those cut down. Of the virgin fibres used in pulp and paper industry, 20% originates from fast-growing plantation forests, and this figure is growing steadily (Financial Times, Report 1995: 53). As the demand for paper has increased, more timber has been needed to meet the demand for wood-pulp. In some cases this has meant the loss of valuable wildlife habitats and ecosystems, when old forests have been replaced by

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[58] Although straw, hemp, jute and manila are also used all tending to replace such traditional fibres as esparto grass and rags (used in Western papermaking). Cotton and linen were originally favoured as they contained so much cellulose, but wood is now popular because it has the advantage of being available in large industrial quantities

[59] Wood used in the papermaking is mechanical; deciduous and coniferous wood.

managed plantations, usually of conifers. For management forests it is important the nature of forests and where they are situated. And, it is still the use of recycled paper better in helping to protect wildlife habitats.

Overpackaging[60]**:** There are every - day goods that may have more packaging for reasons strictly necessary to protect the packaged product. For example reducing the cardboard packaging around a computer might mean that it reaches the consumer damaged or not in the expected condition. But since computers or similar consumer goods are bought from display the actual packaging is not helping in sales, thus it could be one colour print - not laminated but heavy weight at the same time, for safety reasons. It can actually be collected for recycling or reuse by the manufacturer on delivery of the computer or returned by the customer to the shop of purchase.

However, there are cases where extra packaging is used without any additional benefit for the product. Cases of overpacked goods include:

⇒ *Multipacks* - Mostly used as a marketing initiative, where several items are linked together at a special price. Since each individual item was adequately packed, the extra packaging used to link two or more packs is completely unnecessary. Instead the supermarket can have on display big labels explaining the offer and automatically subtract the amount on the till when more than one product is purchased, for example three for the price of two offers that Boots the chemist (UK) is making every so often, without using any additional multi package for this purpose.

⇒ *Luxury pack* - Packaging for luxury items such as chocolates or gifts appear to be unnecessary for the packaged product, but enhance the image of the company and the quality of the container. Sophisticated, smart design can offer solutions in using less - mono material - less inks etc., but combine 'strong' shapes and typographic forms that can make the same impression at the point of sales.

⇒ *Standard size machinery* - Sometimes manufacturers use a standard size of box to avoid investment in different machinery. When it is used for smaller items this inevitably results in waste of resources, as there is a waste space in the container.

Anti-pilfering measures - Small items such as batteries and films appear to be in bigger pack than necessary, due to the experience that the supermarket have from large-scale shop-lifting. By adding cardboard packaging the item becomes physically larger, making it more

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[60] Overpackaging also called extra-packaging or excessive packaging.

difficult to steal. Instead the display stand of such products could be positioned in a place where is difficult for someone to take the risk of stealing.

Environmental legislation affecting packaging

The critical debate about packaging and packaging waste in Europe deals with the role and responsibilities of polluters, material verification, waste disposal systems, financial implementation, economic instruments.

The EC Directive on packaging and packaging waste (Official Journal No C137/65) brings into force a legal framework which applies to all packaging and packaging waste. The EC Directive gives a hierarchy for waste management: prevention first, recovery and as additional fundamental principles, reuse, recycling and other forms of recovering; and, hence, reduction of the final disposal of such waste. Recycling exists primarily to reduce the consumption of energy and raw materials and finally for the disposal of waste. The EU Packaging and Packaging Waste Directive (94/62/EC) set specific targets for packaging waste as follow:

- ⇒ By 30 June 2001, 50%-65%, packaging waste is to be recovered;
- ⇒ Within this general target, 25%-45% is to be recycled, with a minimum of 15% of each material to be recycled.

The Directive applies to all packaging and packaging waste. The scope of the Directive is to ensure a high level of environmental protection, while making it clear that *"the Directive was to ensure the operation of the internal market and not merely contribute to it"*. The Directive *"took the view that evaluation techniques as eco - audits,.. did not at this stage generally make it possible to justify a more specific order of precedence"*.

The directive was welcomed by the Association of Plastics' Manufacturers in Europe, Mr. N. Russotto general director also said that: *"It is vital that waste management policy encourages the development of new technologies and new assessment methods'*. (Monitor, 1994, December Issue, p.18). However, the Friends of the Earth's packaging campaigner Mr. B Southworth comments that: *"as it stands, the Directive fails to establish a clear hierarchy and leaves too much leeway for Member States to prioritise incineration over recycling"*. (Monitor, 1994). In UK The Producer Responsibility Obligations (Packaging Waste) Regulations became law, on 6th March 1997, introducing a new regime making producers responsible for end-of-line products.

Legislation on waste reduction and recycling varies considerably from country to country. Generally more materials are collected in places where legislation exists, but this does not

always improve the recycling rate. Legislation may lead in the US, but finding end markets for the reclaimed products is a problem (McHarry J,1993: 42).

Legislation tends to define and ban environmentally unacceptable products, rather than promoting 'clean products' or introducing new products with best environmental features. Examples are in Denmark ('Danish bottle case') where non-returnable containers are banned, Sweden where used a deposit system on items, to encourage recovery of scrap. In Germany there are in place stringent new standards for recyclable packaging and in France there is a 'packaging degree' mandatory legislation came into force on January 1993.

Also mandatory deposits are applied by law in some countries as an anti-litter measurement; to encourage the use of refillable containers; and to encourage the return of containers for recycling. But it is not always an effective solution, if consumers are not proper educated on how to participate in the re-use or recycling systems. Another problem is the lack of domestic processing capacity in some countries for example, in Germany it led to the dumping of waste paper and plastics in other EU countries, including the UK, undermining the collection and processing of waste generated within the UK.[61]

2.10 Design Management business tool for the environmental accreditation of paper packaging product

Finally this section introduces the design management scepticism that this study uses to interpret the findings during the process of the research. The role of designer and design decision makers is addressed together with the existing methodology in managing and auditing the design process. The design approach is controversial a comparison is made with eco-design requirements, emphasising the necessity of the design management and the role of design in business philosophy.

Across most industrial and service sectors, especially multi-national companies environmental pressures and challenges are being seen less in isolation and more as part of a broad strategy for efficient production process. Such a strategy is able to demonstrate that the notion of 'green design', cleaner technologies, and waste minimisation are becoming more widely understood. The importance of design in helping to reduce the environmental impact of products is also, increasingly recognised.[62]

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[61] National Manufacturing Council (CBI), Manufacturing Bulletin, July/August 1994, No 8
[62] See Potter 1992; Ryan, Hosken and Greene 1992; Whiteley 1993; Graedel 1995; Papanek 1995; Cooper and Press 1995 .

It should be, acknowledged that environmental issues surrounding packaging design is complex form.[63] On the other hand design cannot alone solve the world environmental problems,[64] as designers do not work in isolation, but need to collaborate with other disciplines e.g. mechanical engineering, market research etc.

Greg Eyring (1993) OTA Senior analyst (The Congressional Office of Technology Assessment) recommends that instead of looking at environmental constraints as limitations for design, they should be looked at in terms of an objective of the design process. Designers also are not always addressing the right problems during product development. Indeed, Ashton (1995) accused designers of selecting their own problems to solve within a project, or choosing to spend more time on elements that they consider to be important. Ashton warned that *"where these elements are not considered as important by the client, conflict and misunderstanding can follow".*[65]

Ray Holland (1998) cautioned that *'designers are a dangerous minority in the eye and hearts of those who would maintain the world and its systems, or even regress*[66] Dumas and Whitfield (1990) found where a design manager exists within the company, design projects are more likely to be structured similarly to other projects and considered not to require central control. Those with a design manager favour design operating as a profit centre and perceive the design function as exerting influence upon company policy in staffing, finance and project development.[67] Studies on the use of design by companies have shown that design can contribute to their business performance and competitiveness (Walsh et al. 1992). However, studies have also shown that design is only likely to have a long term impact if the company has an understanding of how to effectively manage the design resource and is committed to building up a design competence (Bruce, Roy and Potter 1995)[68]. Therefore, for a real improvement in environmental orientated packaging design a multi disciplinary team of experts is required within such teams and it is essential to include: packaging/graphics designers; mechanical and electrical engineers; materials specialists;

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[63] Sarri E, & Holland R, 'Eco Design - You have to believe it to be true?', 'Alternatives Realities', IDSA Conference, Sept. 1996, USA
[64] Chemecology, April 1993: 3
[65] Ashton P 'Thinking design through', Design Theory, Volume 3, Design Education proceedings, 'Design Interfaces', The European Academy of Design Conference, University of Salford, April 1995
[66] Holland R, 'Engendering an entrepreneurial spirit through design and design management', "Higher Education and SMEs" Rennes International School of Business, International Conference, March 1998
[67] Angela Dumas and Allan Whitfield (1990) 'Why design is difficult to manage', 'Design Management', London Business School p 31
[68] Bruce M, Roy R and Potter S, (1995) ' The Risks and Rewards of Design Investment', Design Innovation Group, Journal of Marketing Management.

production engineers; market research; environmental specialist (advisor/counsultancy); financial resource manager; test, quality assurance, and service personnel. It has also been pointed out that it is not always the designers that make design decisions.[69] Design management is in a position to bridge the connections between corporate strategy policy; product formulation and implementation of project design.

Design Management is not something new - in 1984, John Butcher, Parliamentary Under Secretary of State, Department of Trade and Industry, UK found design to perform a crucial factor in enabling any company to improve its market performance, but he states:

> *"for such an improvement to be realised, design must be managed as a corporate resource'*. And, *'design should be integrated with marketing and production in a planned and coherent strategy controlled at Board level".*[70]

The 'Design Management' journal published by the Design Management Institute (DMI) since 1989, devotes articles and case studies exploring how design - in products, communication and environment - is an essential resource, a necessary component of organizations. BT (British Telecommunication) for example has a Design Management structure including on Environmental Design Management Group. BT state that:

> *"in any successful and high profile organisation, design is managed in a co-ordinated way and as a strategic element of company policy and image".*[71]

Braun, the German producer of electric household appliances, in its mission statement focus on design and found *"good design to be ecologically conscious"* and *"good design is minimal design"*. Braun principles of good design is deeply rooted in the firm's core values.

Writing on design, Dormer (1990) put the future of design in the context of a growing desire of people for the *"diversity of nature to be maintained, and that they want to be healthier"* as key factors in their demand for more substantial design solutions'.[72] It should likewise be appreciated that design takes place in a complex environment of business, economic, technological and political influences. Understanding this external environment, or background, is crucial to strategic decision-makers. Cole (1994) suggests that design has to be taken into account alongside any assessment of an organisation's own internal environment.[73] Ecological orientated design should be managed internally by the producer

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[69] Sarri E, (1995) 'Green Design: An approach to packaging'. MA Report (unpublished), School of Design & Manufacture, De Montfort University, Leicester - in particular questionnaire analysis investigating designers attitudes to green design pp 23 30
[70] Wolff Olins Guide to Design Management (1984) Foreword.
[71] 'Design Management in BT' Policy and structure - personal correspondence, 1995
[72] Dormer (1990) The meanings of modern design London, Thames and Hudson
[73] Cole (1994) Strategic Management. Theory and practice. DP Publication Ltd, London p 33

company and closely related with companys' corporate and design philosophy. In addition employee external environmental auditors and consultancies can be employed for specific tasks.

Peter Gorb (1990) describes design in relation to various types of design activity including *"those people who are concerned with systems of these things"*[74], and that it is people that make design decisions and should be aware of the design process, requirements and potentials for exploring and managing the business of design. Alan Topalian briefly classified the management of design into two interrelated levels, namely *'the project design management level'* which relates to short-term, relatively confined problems encountered during the administration of a design project, and *'the corporated design management level'* which relates to long-term implication of the relationship between an organisation and its environment, and the contribution that design skills activities make to this relationship.[75]

Mark Oakley (1984) also identified two levels of design management, *'design project'* and *'design policy'* management and attempted to describe their characteristic details.[76] In relation to this study, Oakley's approach to design management relates the project design such as packaging design with the design policy of the organisation. But there is no reference in the corporate policy to such an environmental policy.

However, Chung's (1992) approach is more comprehensive as he presents three conceptual levels of design management: the corporate (strategic) level; the design organization (tactical) level; and the design (operational) level.[77] This approach applies to this study in building the models of environmental analysis, as it examines and recommends environmental methodology at corporate level related to the organisation design activities and with effects to the design operation - product level. In comparison to top to bottom approach to environmental policy, this study found the same approach in managing and auditing environmental design activities, with long effects on products environmental performance. Prof. Kyung Won Chung (1992) identifies three major categories of meaning of design management classified as follow.

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[74] Gorb, P. (1990) 'Design as a Corporate Weapon', CHICAGO, Spring, pp. 1-4
[75] Topalian, A. (1984) op. Cit, p 4
[76] Oakly, M. (1984) op. Cit, pp. 9-18
[77] Chung K (1992) 'Developing a Postgraduate Curriculum in Design Management for Korea', Journal of Art & Design Education, Vol. 11, No 1, March, pp 89 - 103

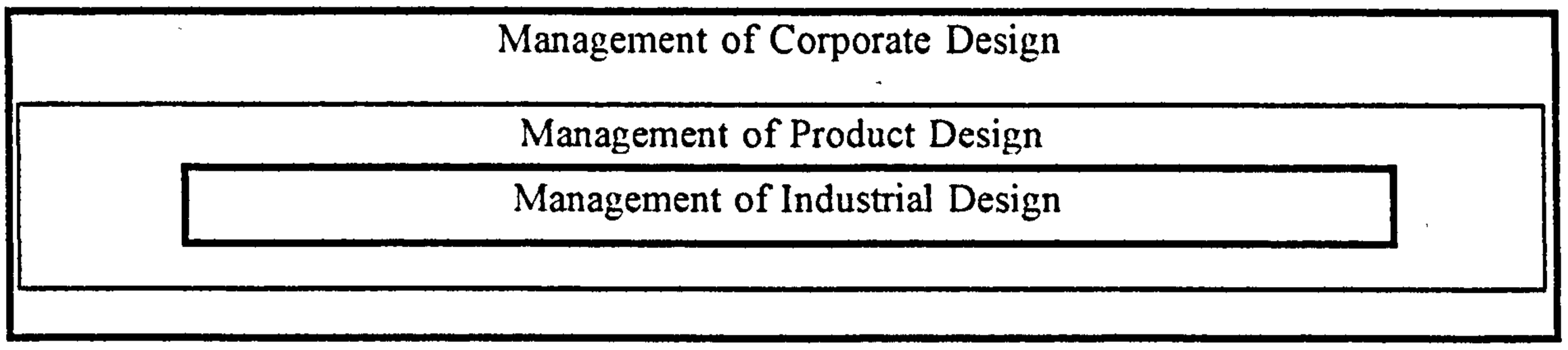

Table 2.1 ***Classification of Three Major Categories of Design Management***[78]

Chung placed the management of corporate design as a broader category that includes the management of product design and industrial design as well, while industrial design is under the spectrum of product design. For packaging design, design managers should consider the aspects of corporate design as packaging carries brand values in consumer markets and product design in the formulation of the package itself - while industrial and engineering design applies in packaging (3D structural packaging) in the sense of material choice and standard shapes available in the market.

Deanne Richardson has defined the characteristics of corporated design strategy as follows :

> "by transforming business ideas into tangible artefacts, the corporated design strategy demonstrates how the product / marketing offering will communicate the company's desired strategic positioning in the perception of the customer. Thus give management a window through which the company's business agenda for the future can be visualised in the present."[79]

These characteristics of corporate design strategy are the key to success when applied to the use of product environmental information to communicate the environmental values of a companys' strategy.

Kotler and Roth (1984) have argued about the interrelation of design benefits and design management. They found that while quality design offers a company several benefits, design management can *"lead to heightened visual impact, greater information efficiency, and considerable consumer satisfaction"*.[80]

The design approach in formulating the product development philosophy can be achieved by a well co-ordinated team of designers with different design specialities. In this vein, a

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[78] Source: Kyung Won Chunk, 'The Meaning of Design Management and its Strategic Value', '4th International Design Management Research and Education Forum', Design Management Institute, April 1992, London

[79] Richardson, D. (1989) Design Leadership in British Business: The Role of Non - Executive Directors and Corporated Design Consultants', paper presented at a seminar organised under the auspices of the Confederation of British Industry Marketing

corporate design group -internal (or external, but well aware of companys' philosophy) or a design consultant firm and, if it is possible, a specialised environmental advisor can be ideal for the combined design approach. An ideal symbiotic relationship should affect each stage of a products' life cycle. The management of design process should touch upon business philosophy and apply at the very early stage of product formulation. Lynne McPeake, the graphic design partner of Boxton Wall McPeake a Manchester based design consulting firm, stressed that often the graphic designer could present something much better to the client than the product designer could, but there was often three dimensional input from the product people into the structural pack.[81]

Oakley (1990: 327) talks about competence in project management and found that *'the best designers in the world will be unable to produce good results if they are working on poorly administrated projects".*[82] The design strategy provides a comprehensive framework in which the firm's design activities can be integrated with the total efforts of the company. The design manager takes responsibilities about how to set up the system, how to monitor it, disseminate responsibilities for the efficient operation of the project and consider accountability during implementation.

The strategic approach that the design management offers on product design are improvements in: cost; leadership; market niches and differentiation. Ray Holland sees:

> "the potential of design as a corporate resource and design management as a problem solving tool is greatly under-valued as a means of achieving competitive advantage".[83]

The essential role of design management as a tool for success in packaging business is outlined in figure 2.1 gives the relationship of design management with company's environmental policy/design policy; design strategy and design process and touches upon the contribution of design management as a competitive advantage for companies, through differentiation in packaging design. In addition to managing differentiation on environmental orientated packaging design, there is a need to be innovative and creative, it needs to be pioneering compared to existing packaging design.

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[80] Kotler and Roth (1984)'Design a powerful but neglected strategic tool', journal of Business Strategy, vol. 5, No 2, Fall, pp 16 -21

[81] McPeak, L. (1988) Quoted by Buttery, H. In 'Partners in Creation', Design (London), 470, Feb. pp 44-45

[82] Oakley, M. (1990) Design Management - A handbook of issues & methods, Basil Blackwll Ltd, UK, p 327

[83] Holland R, *'Engendering an entrepreneurial spirit through design and design management'*, "Higher Education and SMEs" Rennes International School of Business, International Conference, March 1998

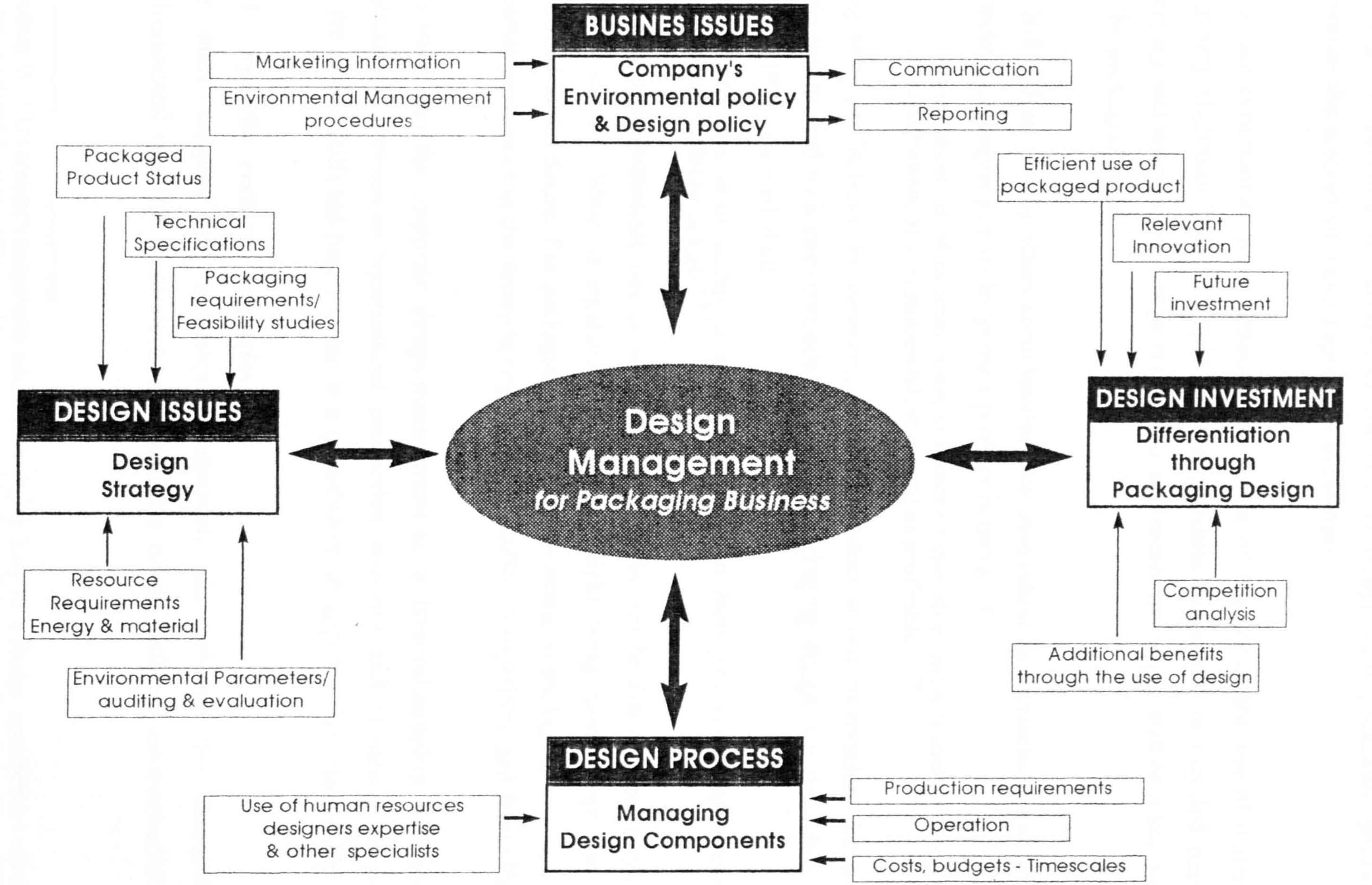

Figure 2.1 Outline of the Design Management for Packaging Business

The existing legislation on packaging and packaging waste puts targets on business for recycling and recovering of the waste that they produced. Although not enough indicators are given for businesses on how to achieve these targets. And, certainly there are no standards or direction for companies on how to design such packaging products that minimises the amount of waste disposed of in landfills.

There are expectations from technology in terms of improving the use of materials and machinery (lightweight for example and less polluting processing of recycled paper). But managing and investing in design innovation and creativity might well be a key to success for the packaging business.

Dr. Bill Hollins (1996) offers considerations on innovation in connection with managing, formulating, designing or re-designing a product in terms of:

> "innovation, it takes more time, it is more expensive and it is more risky. But being an innovation, if it is successful, it should be profitable". [84]

Long term profitability by patenting a unique product is one motivation for packaging businesses to deal with environmental issues and packaging design. On the other hand as Hollins (1996) noticed that:

> *"investors must accept a slight reduction on their fast return of investment to finance future design".*[85]

And, packaging businesses can avoid future liabilities by not be able to meet recycling and recovery targets. What is regulatory at present, might being more strict - mandatory controlled in the future. For packaging businesses investing in packaging innovation could be better positioned in the future in terms of profitability, competitors and future liabilities.

This study sees the corporate design management as an inter-relationship with long term implications, between an organisations production activities and its natural environment, and the design skills and performance as a contribution to improve this relationship.

2.11 Specific research inquiries

The study suggests that a design management approach to the formulation of environmental concepts on products and packaging related with the environmental policy,

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[84] Hollins W, 'Are current management practices damaging long-term design management effectiveness?' '8th International Forum on Design Management Research and Education', Barcelona, Nov. 1996
[85] Ibid.

corporate philosophy and design strategy, may lead in optimisation of environmental products' characteristics.

A survey on consumers environmental behaviour in 1996, carried out by the UK Ecolabelling Board in conjunction with the Department of the Environment and the National Consumer Council found that:

> "the combination of the ecolabel (EU) with on-pack information from the manufacturer is much more powerful in its effect than a simple addition of the two taken separately".[86]

The UK Ecolabelling Board (Newsletter No. 7, April 1997) comments that at this time (that the EU ecolabelling is not so familiar to consumers), there is this consumer demand for reassurance on both elements. While consumers preference is not towards the use of a simple ecolabel but towards a label accompanied with environmental information on the pack about the manufacturer, that imply responsibilities in managing the environmental impact of products and packaging related with the corporate policy and manufacturer process.

The role of designers in the development of ecolabelled goods, given by The Smallpiece Trust (1989) in terms of that:

> *"designers can be responsible for specifying up to 75% of resources used to manufacture products".*[87]

However, according to Goggin (1994),

> "a voluntary market orientated approach (means ecolabelling schemes) is not necessarily ideal in terms of long-term environmental solutions or promoting environmental sensitive design", he also comment that *"ecolabelling criteria describe a design solution space".*[88]

Goggin (1994: 462) defined the problem that emphasis from ecolabelling schemes is based at present on product configuration and performance and not on delivering a functional outcome. He suggests other measures such as minimum environmental standards or tax incentives as more effective ways of promoting innovative and functional outcomes for assessing the environmental impact of products.

The plethora of existing labels and the diversity of criteria for their awarding them make difficulties especially for multinational corporations. As environmental labels operate in a number of countries (according to EPA Report, 1993, 22 countries have ecolabel programs

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[86] *'A study on consumers behaviour'*, UK Ecolabelling Board Newsletter, No 11, April 1997
[87] The Smallpiece Trust, *Design for Production*, Seminar notes, Leamington Spa, UK (1989)
[88] Goggin P, (Oct. 1994), *'An appraisal of ecolabelling from a design perspective'*, Design Studies, Vol. 15, No 4, p. 459 and 462

with many more considering them) they serve the need for dissemination and use of environmental information and are not going to disappear. They will continue to be developed, but a harmonisation system for these programmes could incorporate criteria at an international level (as ISO 14000).

At a stage of industrial ecology when life-cycle assessment methods are still relatively unfamiliar, labelling programs offer the promise of rapidly implementing LCA methodologies. Graedel (1995) pointed that a potential disadvantage of the labelling programs is that unless their criteria are carefully chosen, environmentally suboptimal performance might be encouraged.

> There is *a research need to establish standardised* allocation procedures which identify and quantify the inputs from the environment and the outputs to the environment of the product systems investigated. It is *a research need to establish practical rules for LCA* inventory, which have a general applicability in ecolabelling studies, and procedures for dealing with impact categories for which equivalency factors are unavailable. *(Group des Sages, Leiden, May 1994)*

The PRO CARTON a pan-European association of cardboard and carton manufacturers, supports the concept of Life Cycle Analysis as a welcome and important tool to help design packaging policies in Europe, and is ready to co-operate in developing proper LCA principles.

> It also believes that: "although many LCA today give valuable information on environmental performances of products or processes, the current state of LCA development is limited and any LCA should not yet be used as a decision tool to compare competing products". (PRO CARTON: 1995)

The response of the British Retail Consortium to the Consultation Paper on Producer Responsibility for Packaging Waste is that :

> "The biggest problem facing both the UK and Europe in pursuing producer responsibility law for packaging waste is the lack of quantitative data and the potential costs of collecting it". (Packaging Today :1995)

Environmental Management Systems assess the environmental performance of a company rather than the product. Typically, those companies certified or verified are allowed to use a logo on corporate publicity material but not on their products and packaging. But, even if EMS do not certify/verify products and packaging, product and packaging remain interconnected component of business activities.

EMS are a 'necessary' part of business activities towards good management and good housekeeping and are giving reputations and credibility in business environmental performance. Barrett (1995) gives an example that one leading tissue products manufacturer in the UK has been told by a major retailer client that they will be expected to

have a certified environmental management system.[89] Both Confederation of European Paper Industries (CEPI) and the European Tissue Symposium (ETS) propose this approach as an alternative to eco-labelling.

According to CEPI (1995), the advantages of EMAS is that, unlike eco-labelling, it takes account of different national starting points in the regulatory field and focuses on environmental improvement.[90] However, the International Institute for Environment and Development (IIED, 1996) find that because of this very aspect of EMAS is likely to make it unacceptable as an alternative to eco-labelling, as it potentially allows all producers to be certified even if they vary considerably in terms of performance.[91]

This gives an indicator that environmental performance should probably be addressed in different levels of environmental commitments. Based on this recommendation, some points to be considered include:

1. The effects of environmental packaging legislation is a 'push' for companies to radically rethink their environmentally responsibilities.
2. The lack of reliable environmental information (such as standards and LCA methodologies) and quantitative data, supporting 'sustainable' development for paper packaging companies;
3. The role of voluntary bodies such as the EU Ecolabel scheme on the way to give the basis for a total environmental analysis and ecological assessment - establishing the ground for companies to be under one roof sharing the same standards and measurements, common environmental initiatives and responsibilities in the market place;
4. The significant contribution of design and design management towards achieving higher environmental credentials on products (such as packaging) while securing acceptable environmental performance for big enterprises.
5. The need for the development of a systematic approach to measure and evaluate products environmental claims as a marketing tool, relevant to and, co-ordinated with a set of targets delivered from the companys' policy.

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[89] Barrett, J. (1995), European Policy -Makers Soften Command and Control Approach, in 'Pulp and Paper International', June issue, pp. 74-77
[90] CEPI (1995), Miscellaneous Press Releases on Eco-Labelling, Confederation of European Paper Industries, Brussels, Belgium
[91] IIED (1996) 'Towards a Sustainable Paper Cycle', International Institute for Environment and Development

2.11.1 Establish research directions

Currently, there is a need by the EU manufacturers to set definitions, types of claims that can be made for paper packaging products and procedures for substantiation. The following matters require further consideration:

1. Attention to be given to alternative approaches to eco-labelling in particular for paper packaging products.

2. The need for ecolabelling schemes to become more flexible and to take account of different environmental priorities as a way to avoid discriminatory trade effects.

3. The environmental labelling schemes need to explore performance standards, i.e. environmental management systems, while considering the environmental impact of the product and the design process on a "cradle-to-grave" basis.

Companies should act in an ethical manner towards the consumer by taking their environmental initiatives seriously in the form of a total environmental assessment and cost benefit analysis, to be able to assess the environmental impact of their products and services. They should adopt a proactive environmental marketing strategy which has to be transparent, true and open. They should control their environmental performance by compliance with acceptable environmental standards (i.e. BS, ISO, or Eco Management and Audit Scheme) and legislation (e.g. EU Directive on Packaging and Packaging Waste).

It is suggested that manufacturers need adequate support to formulate methods of assessing the environmental impact of their products systematically. In more analytical format, there is research needed in the area of packaging paper production:

⇒ To establish the review to be carried out and the way in which the environmental analysis (LCA) could be conducted.

⇒ To create and test a *model* that enable managers and designers to assess and measure the environmental qualities of paper packaging products.

⇒ To develop and examine specific criteria (rating scales; labels;) which could be adopted for paper packaging products.

Figure 2.2 *'The format of the hypothesis'*, describes the purpose of the study as a reference source for those conducting evaluating and measuring environmental impact assessment for paper packaging products.

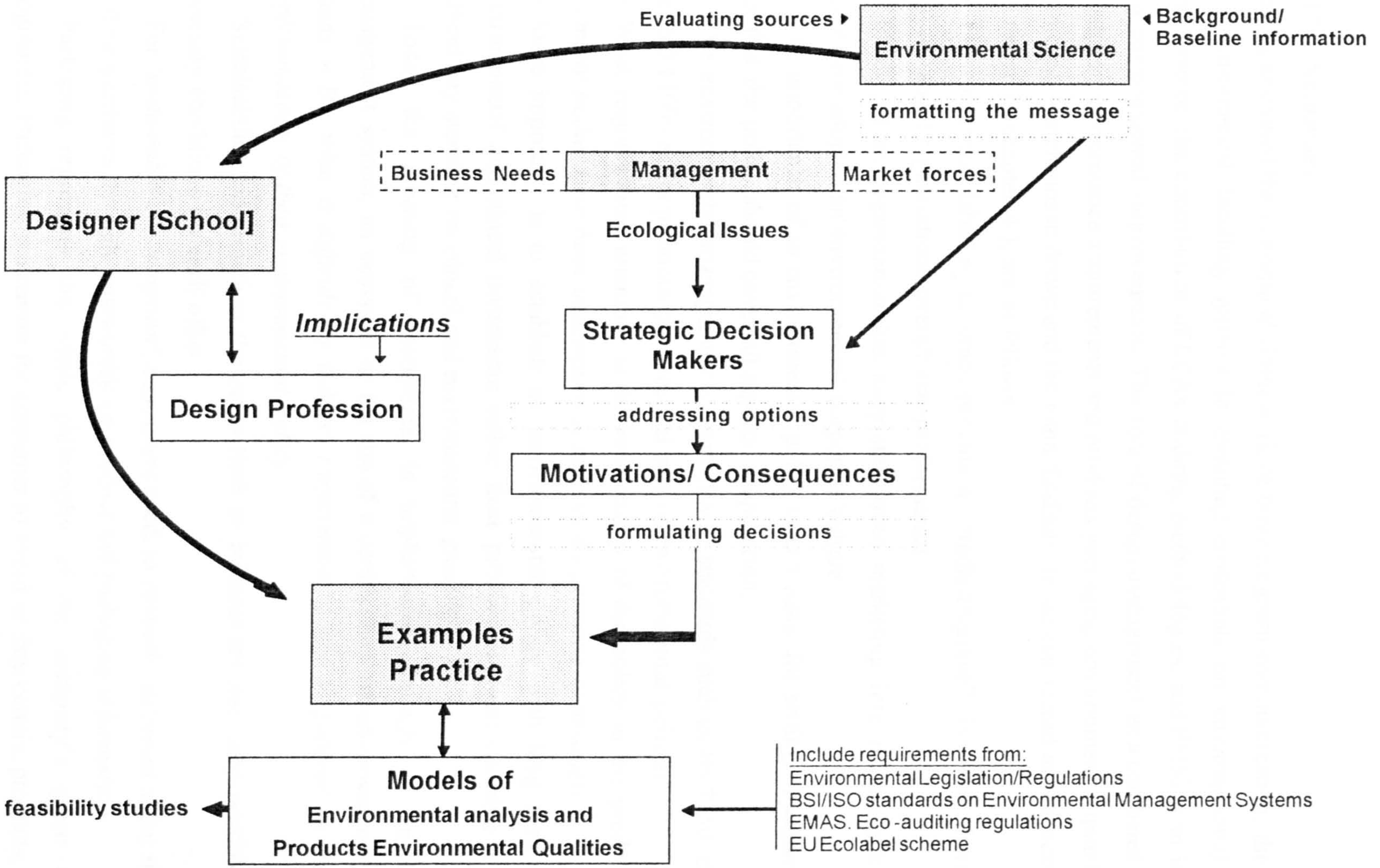

Figure 2.2 The format of the hypothesis

Figure 2.2 emphasised that the study refers to the managerial decision making process and works to develop a generic model for informing the manner in which companies and packaging product designers are able to meet ecological assessment criteria.

2.12 Summary

Having examined the conceptual framework of business green communication, the potential of environmental labelling systems in awarding credentials on environmental products performance, the contribution of LCAs, auditing methodologies, and EMSs as an instrument 'for environmental improvements. The role of design management as a combined approach to support performance requirements and products/packaging environmental qualities is also examined. Conclusionsn drawn and the main findings, to be considered at the next stage of the research (chapter 4.), are as follows:

⇒ Environmental labelling schemes provide a "cradle-to-grave", however there is some concern about organisations overall eco-performance.

⇒ Ideally, if an organization has integrated green marketing into its strategic focus, it would have adopted an environmental corporate culture.

⇒ The importance of an environmental policy is as a basis for setting objectives and the fact that the policy should cover all aspects of operation.

⇒ The environmental management system (EMS) standards such as BS 7750 EMAS and the ISO 14000 series promote the practical role of environmental policies.

⇒ What requires more attention is the relationship of the policy to the product itself. - *Not many studies have been undertaken to support the greening of products.*

⇒ More important is to establish an environmental policy with long term corporate environmental and ethical investment rather than produce products claiming to be green without any standing on ethical and environmental grounds.

⇒ Today the greening of enterprizes is implemented through an environmental management system, an eco-audit or the use of a certification of environmental products claims. - *But what is difficult for todays' corporation is how to proceed in the efficient implementation of their environmental policy.*

⇒ Sustainability and growth at the same time in business are not only possible but also necessary conditions for each other.

⇒ For *'sustainable consumption'*, consumers need, to properly informed about the impact of their purchases through trustworthy on product and packaging information

⇒ Packaging represents the whole philosophy of the company's green marketing programme. Packaging is a reason for consumer to avoid or buy certain products, thus is in the centre of marketing communication

⇒ The way that environmental information are presented on packaging creates the *information gap* where not enough information available. And, the *credibility gap* by products misleading environmental liabilities and uncontrolled environmental claims.

⇒ LCA methodologies are in a developing stage and relatively unfamiliar. - *The main purpose of an LCA is to identify where improvements can be made to reduce environmental damage.*

⇒ LCA is viewed by this research study as a concept and a methodology which provides data for environmental impact analysis and evaluates the environmental effects of a product or activity holistically, by analysing the entire life cycle of a particular material, process, product, technology, service or activity.

⇒ Eco-audits is what is required to compare and assess different available options towards environmental improvements.

⇒ Combining LCA findings in a broader evaluation system related to the organisations' environmental performance and activities, such analysis provided by the ecological audit.

⇒ In Europe it is under development at National European Government levels, the 'eco-audit' and 'eco-labelling' regulations, potential land reclamation liability, suppliers audit, the BS7750 and ISO 14001 on environmental management, compatible with the EC's Eco - Management and Audit Scheme, (EMAS).

⇒ Design audits (in general) serve much the same purpose as financial audit. - Design audits suffer from the same problems as any other audit that is, how does one define the boundaries of a design audit, what are the criteria for assessment, how should it be implemented and by whom.

⇒ The design profession must embrace the *'communication audit'* - as related to corporate identities. - to understand the corporate philosophy and strategy; secondly, to understand how the company operates, and finally, to understand how it communicates and to whom.

⇒ There is need for marketers to assess corporate design sensitivity and measure design management effectiveness.-

⇒ There are emerging pressures for packaging design to be audited - as decisions affecting the environmental impact of a packaging are taken during its design and development stage

⇒ An investigation should be carried out into the environmental mechanisms at companys' level with effects to and considerations of the final product and packaging. - *'Environmental mechanisms' includes environmental management and environmental audit.*

⇒ BS 7750 does not set out environmental performance guidelines, since it recognises that every business is different, - BS 7750 requires from business to have: a preparatory review;

an environmental policy; clearly defined responsibility; up-to-date records of relevant legislation relating with business activities; a 'register of significant effects'. ISO adds another dimension to the field of EMS - internationalisation. - EMAS and Standards are not competitive but complementary approaches to the same end.

⇒ The EU packaging and packaging waste Directive "took the view that evaluation techniques as eco - audits,.. did not at this stage generally make it possible to justify a more specific order of precedence".

⇒ Legislation tends to define and ban environmentally unacceptable products, rather than promoting 'clean products' or introducing new products with best environmental attributes.

⇒ Instead of looking at environmental constraints as limitations for design, it should be looked at in terms of an objective of the design process.

⇒ Designers also are not always addressing the right problems - design manager exists within the company, design projects are more likely to be structured similarly to other projects - design manager favour design operating as a profit centre

⇒ Studies prove that design can contribute to their business performance and competitiveness - studies have also shown that design is only likely to have a long term impact, if the company has an understanding of how to effectively manage the design resource

⇒ Design management is in the position to bridge the connections between corporate strategy policy; product formulation and implementation of project design. And, Design management should be addressed as a strategic element of company.

A methodological approach to the research problem is the subject of the next chapter. This approach suggests that in examining environmental auditing methodology for the design of paper packaging, the body of knowledge in the field of environmental issues affecting packaging and methodology on assessing products environmental information should be examined along with the development of the EMSs. The aim is to bring together and support the business environmental profile in the packaging business sector. Based on this suggestion a framework for the development of the model of environmental analysis for paper packaging products is proposed in terms of its effectiveness in use, user understanding and evaluation.

CHAPTER 3. RESEARCH METHODOLOGY

3.1 Introduction

In the previous chapters the research problem has been identified and the hypotheses paths to be examined have been stated. Following this chapter is a proposed framework to proceed in solving the research problem and achieve the recommended solution., the *model* of environmental analysis for paper based packaging. It starts by presenting the stages of the research activities. Next, it discusses the approach of the current research by determining the appropriate research methodology. This approach consists of the critical perspective orientation paradigm applicable in environmental research (proposed by Welford, 1997) and the hard system approach (proposed by Waring, 1989). The research design described and the research methods used in the different stages of the process of the research are discussed. The employed methodology mainly occupies the stages followed by descriptive research proposed by Allison (1993). The data collection techniques include surveys, interviews, attitudes questionnaires, performance and acceptance tests. The data analysis methods include statistical analysis and interview protocol analysis. Within this context the validity and reliability of the methods, the techniques and procedures of data gathering and analysis are examined.

3.2 The Proposed Research Framework

The literature review (see Chapter 2.) found a respectable amount of research in the field of environmental management and much more recent research (dated in the 1990s) regarding environmental product design. However the literature sources did not reveal much insight related with the formulation of environmental product design as a result of companies' policy. In addition, much of what exists about LCA methodology for ecological assessment is not directly related with packaging design and, as LCA methodology is in a developing stage, some information is anecdotal and cannot be verified. Some studies produced by individuals in many cases cannot be substantiated by a third party, on the basis of the source of the information provided.

There is a lack of in-depth research into environmental strategies applicable in product design, such as packaging towards awarding an independent certificate for product environmental qualities (draft standards ISO 14001 working in this direction).

Based on these recommendations a framework has been designed dividing the research activities into the five stages outlined as follow:

1) **Formulation Stage** - Conceptual framework (analytical and theoretical approach). Groundwork (Field research) established on initial thinking and understanding about:

⇒ the different environmental labelling systems; LCA methodologies; eco-auditing and investigate attitudes, perceptions and understanding on these issues from parties involved (designers, companies, governmental bodies and organisations).

⇒ consumer behaviour with regard to green marketing, perception and understanding about products environmental labelling.

⇒ review of information relating to companies' environmental policies and strategic management systems.

⇒ cross-examination of the information and developments regarding environmental issues and the effects on packaging design.

2) **Explanatory Stage** - Critical review (Classified data). In this stage evaluation of the information from the stage above is used to formulate different hypotheses paths that are explored during the preliminary study. This stage is devised in two phases but, they are examined together because several activities occurred simultaneously to generate specification for inclusion on the *model* of environmental analysis, formulated at the next stage.

Explanatory Stage **Phase A.** The work at this stage concentrates on:

⇒ acquisition of senior executives, researchers and others interested in the packaging business sector through the first survey aimed at determining causal relationships and contradictions in the use of environmental management systems and on packaging products environmental information.

Explanatory Stage **Phase B.** The work at this stage concentrates on:

⇒ examination of different hypotheses paths, through semi-structured interviews with interested parties about methodology for environmental labelling and environmental auditing with regards to paper packaging products.

3) **Investigation Stage** - Critical review (Classified data). The starting point in this stage was the evaluation of the observations from the previous stage of the research activities that enable the researcher to formulate different formats of *models* that assess the environmental performance of products and packaging related with companys' environmental policy. The progress of the research was reported in relevant international business and design events and each format of the *model* presented, aiming to gain feedback in terms of generated questions for improvements in the format of the models. Then each *model* was presented in a number of interviews with people involved in the packaging business sector - a number of questions addressed and recommendations made for improvements and evaluation. These recommendations were taken forward to the second

survey conducted to generate specifications in auditing methodology for inclusion in the final model.

Investigation Stage **Phase A.** The work at this stage concentrated on:

⇒ participating in workshops/ seminars and other similar events, joining a team of industrialists, academics, researchers presenting formally and reporting the progress of the research in order to gain feedback on the different stages of the development of the model. And further to generate questions for explanatory study, in relation to the methodology for products environmental auditing and business operation.

⇒ evaluation of the different formats of the model by parties involved through structured and semi-structured interviews

Investigation Stage **Phase B.**

⇒ principal investigation second survey. The second survey piloted word-wide, but the representative sample of the survey conducted in UK packaging businesses.

4) **Testing and Evaluation Stage** - Transformation of the Data (Final synthesis). The work at this stage concentrates on:

⇒ development of the final model of environmental analysis for paper based packaging, based on the results and recommendations from the stage 3.

⇒ testing and evaluation of the final model through structured interviews. Recommendations arise and modifications are made.

5) Future Development stage - used to demonstrate possible method for implementation proposals of the model for practical applications - experimental case studies.

3.3 The Approach

In the book 'Hijacking Environmentalism' published in 1997, by Richard Welford Professor of Business Economics at the University of Huddersfield, UK Director of the Centre for Corporate Environmental Management and editor of the Business Strategy and the Environment academic journal comments that up-to-date research into the links between business activity, the environment and sustainable development has been inadequate in terms of both quantity and quality[1]. There has been too much concentration on environmental research and a fixation by trying to prove that eco-efficiency will improve the economic performance of the firm.

Welford suggests that these approaches are flawed because they are limited and have, in general, not added significantly to the debate over sustainable development. He identified

[1] Welford R. (1997) Hijacking Environmentalism. Earthscan. p 228-234

the need for a much more critical perspective which stresses both knowledge and action. According to Welford:

> "there is a need to see much more normative research which challenges business to do things differently and lays out an agenda for change" (Welford, 1996: 229).

The research approach therefore aimed to grasp the need for change amongst policy makers and decision-makers. This research it is not only about eco-efficiency and environmental product design, or not merely about integrating ecology with economy and it is not about putting an existing environmental management system in place. The research approach constructively criticises, examines and identifies the contradictions and tensions which exist between business environment its stakeholders and the implications of business activities within product design on the context surrounding the natural and social environment.

Approaches to business related research are represented in Figure 3.1 the first cluster gives the objective - order paradigms thus research stresses the use of scientific method with an emphasis on statistical techniques. It can be considered as positivism based on determining causal relationships between variables and then using this information to manipulate and control the social world. But this approach is sterile with little vision and no underlying ends being identified (Welford 1997: 232). The research approach with the subject - order orientation (cluster 2) has enriched our understanding of the modern business enterprise and its activities, but much of this research has been very descriptive and is often not easily generalizable. According to Welford this sort of research provides little basis on which to interpret events in society as a whole.

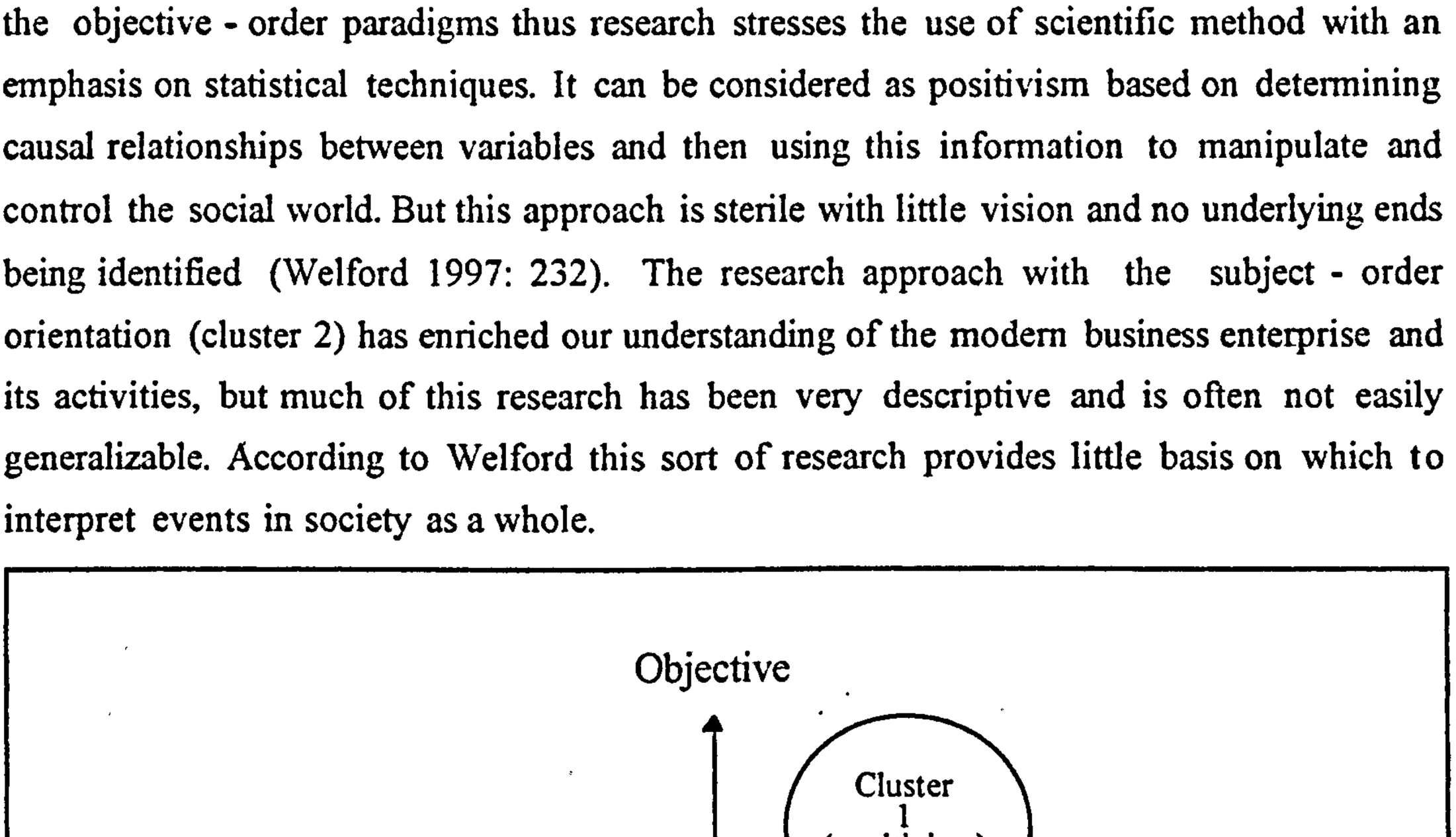

Figure 3.1 Comparative Approaches to Research ***(derived from Murray and Ozanne, 1991)***

The critical theory represented in the third cluster stresses both the objective and subjective approaches to research but sees the product of its research as aiming to create changes. Critical theory stresses the need for a political and moral social science, designed to change society for the better (Fuhrman 1979). The research approach on a critical ground separating the facts (existing knowledge) from how it is used (interests) is an approach that challenges the existing system and status differently from interpretivists and positivists that they simply reinforce and replicate existing structure and functions on business and environment research. Critical theorists, on the other hand according to Welford (1997: 230-235) believe that science is an activity not far removed from practical and moral action.

The critical approach adopting by this research study aims to generate questions and accept facts after considerable thinking about their validity based on the grounds that are reinforced or generated. This approach is suitable for the study, because even if there is research in the area (on environmental management systems; and product design) the format that the facts (secondary research findings) are presented sometimes represent individual interest, i.e. research conducted by a private organisation for a particular company; or for a public sector under the umbrella of its own interests and limitations;

The research about environmental labelling and product design (such as packaging) needs to be more open, honest and reliable. Labelling systems used as a marketing tool promoting products with less impact on the environment, but on the other hand products such as packaging have their own specific characteristics, formulation and product stewardship making it difficult to participate in a broad orientated labelling system (such as the EU). Alternatives approaches to ecolabelling suggested by the study under a critical perspective orientation which examines the situation and the availability of the current data (see Chapter 2.) and the position of the parties affected (see Chapter 4.).

This research study challenges an agenda for change by incorporating a critical analysis in a system based approach[2] research methodology. The evaluation of the data (research findings) on different stages of the research backed up by the critical theory, but the *model* of environmental analysis is built up following the methodology of hard systems approach. Waring (1989) who defined hard systems as:

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[2] The system approach is the term given to the analysis of change situations which are based on a system view of the problem (see McCalman and Paton 1992: p 49).

"Hard systems have characteristics such as clear structures and well defined processes that are readily measurable. Such quantifiable attributes enable a system's behaviour to be predicted, monitored and controlled. The world-views of people who own or operate hard systems must be taken into account but are not considered to be of *central* importance. The use of hard systems ideas implies a particular view to the nature of problems".[3]

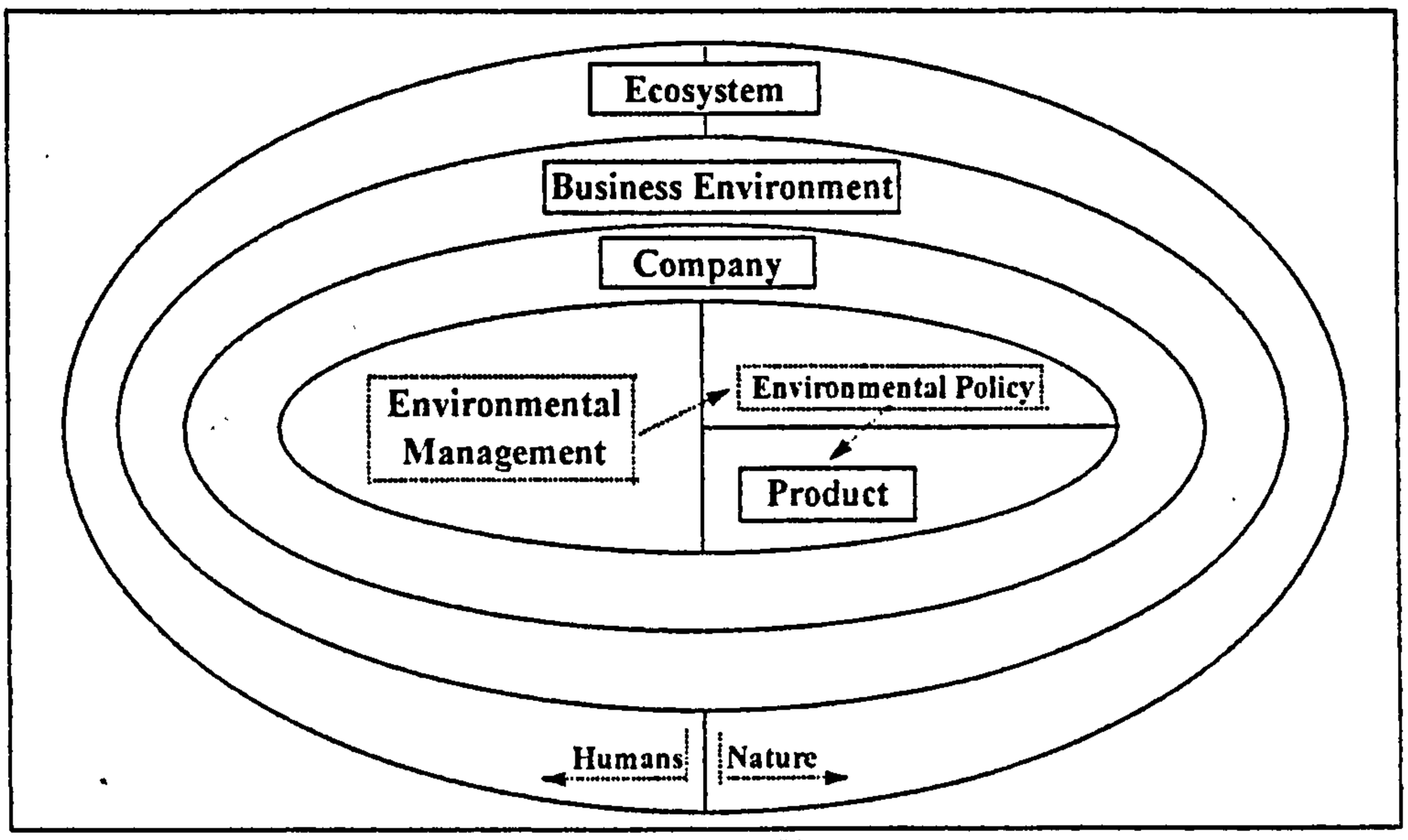

Figure 3.2. A product as a subsystem of the ecosystem

The generic scientific perspective taken by this research on hard systems attempts to formulate the *model* of environmental analysis, appears in three ways, as shown in figure 3.2. Firstly, a company is seen as a subsystem of the business environment which is a part of society. This is part of human and natural environment which, in turn is a subsystem of the ecosystem. Secondly, environmental management forms a part of company management. Business environment effects company management and its environmental management, but according to Child (1984) managers can also affect some of the business environmental factors in order to reach the goals of their company. Managers should use environmental management to serve the companys' goals that are usually defined in terms of high profits, growth, stability and long term survival. Thirdly, the environmental policy that is adopted by the company and the environmental targets on product design and packaging is a subsystem of strategic environmental management. The environmental policy formulated is based on the companys' strategic goals and environmental management principles. Since the development of product design and packaging assists the company to meet these goals, product design should be viewed as a result of companys' environmental policy.

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[3] Waring A., (1989) Systems Methods for Managers. A Practical Guide, Blackwell Scientific Publications, Oxford, p. 52

3.4 The Methodology

Methodology can be defined according to Bogdan and Taylor (1975: 1) as *"the process, principles, and procedures by which we approach problems and seek answers"*. Based on this definition 'methodological question' are generated for this research study. Such questions grasp the 'theory' of business environmental practices related with the methodology applies for developing 'hypotheses' on environmentally orientated product optimisation. The format that the research questions are placed, applied basically on the principles of descriptive research.

> "Descriptive research sets out to seek accurate and adequate descriptions of activities, objects, processes and persons. Whenever possible and appropriate, such descriptions are rendered quantitatively as this enable statistical analysis to be made. (....) It was stressed that research was not only concerned with description but also explanation. Descriptive research, therefore, is not only concerned with *fact* gathering but also *identifying* and *predict* relationships in and between variables." (Allison B., et al., 1996, Research Skills for Students, Kogan Page, UK, p. 14)

The stages in descriptive research provided by Allison (1996, pp. 14-15) are:

1. Examine the problematic situation.
2. Define the problem and state hypotheses.
3. List assumptions upon which the hypotheses and procedures are based.
4. Select appropriate subjects and source materials.
5. Select or construct techniques for gathering data.
6. Establish categories for classifying data - these needs to be unambiguous, appropriate and capable similarities and differences.
7. Validate data gathering techniques.
8. Make discriminating objective observations.
9. Describe, analyse and interpret findings in clear and precise terms.

The first two stages of descriptive research as listed above are covered in Chapter 2. while the techniques, procedures and validation of data gathering are described in this chapter. The following stages used for each category of descriptive research adopted by the study. In each research stage questions generated to test the hypotheses and bring evidence that is used to support the formulation of the *model* of environmental analysis. The research approach and the expected outcomes are outlined in each stage. There are many different forms of descriptive research and these fall into a number of categories, categorised by Allison (1996, pp. 15 -17), as follows:

1) **Surveys** are concerned with collecting data about the occurrence or incidence of events or instances in varying situations and circumstances.

2) **Case Studies** are studies of particular events, circumstances or situations which offer the prospect of revealing understanding of a kind (.....) Case studies, particularly if chosen to represent instances which are different in degree although not in kind, tend to generate conclusions from the particular which may or may not be applicable to the general.

3) **Casual - comparative studies** set to determine the relationships which exist between factors, variables or dimensions in order to explain either their coincidence or their interdependence.

4) **Correlation studies** are pursued on the same premise as casual-comparative studies but are dependent upon two or more variables being present as dimensions of the same phenomenon.

5) **Developmental studies** and 6) **Trend Studies** both study the changes of a phenomenon over time.

The current research used all these categories of descriptive research, except developmental studies and trend studies as they are not applicable. The preliminary survey and casual-comparative studies were used at the explanatory stage of this research to investigate attitudes about environmental labelling in relation to environmental impact of packaging products. During casual-comparative studies conducted through interviews with packaging companies, the environmental performance of paper packaging product was considered as the dependent variable and the environmental management system and policy used by the businesses that produce such products as the independent variable

To study environmental analysis methodologies and ecological auditing descriptive research was used in the format of the second survey and correlation studies to assist in determining the interrelationships between business environmental activities and product design (packaging), to identify areas of 'weakness' and to create variables related to attitudes and inter-relationships at corporate level. Mini case studies were used to propose specification of the practical application of the *model* of environmental analysis.

The analysis of the findings from the surveys and interviews are presented in the following chapters, while each stage underpins the research process towards the creation of the *model.* The use of descriptive research techniques for this research study bring appropriate subject and source materials; assist to establish categories for classifying data and interpreting findings for observation that included in the creation of the final *model*. The final *model* development, implementation and testing used the hard system approach protocol described in a following section. The formulation of the model is closed with action research that defined as a particular kind of intervention in a situation, with many of the characteristics of experimental research. Experimental research characteristically is the deliberate manipulation of certain factors under highly controlled conditions to ascertain how and why a particular event or condition occurs. Action research is invariably a collaborative venture,

critical issues relating to such matters as the formulation of hypothesis, identification of variables and the nature of the innovation or intervention are part of the ongoing discussion and negotiation with the other participants as the research progresses within the real life situation.[4] Action research conducted in the final part of this research project formulates the *model* of environmental analysis for auditing design and design management related activities and tested for feedback in a number of interviews. The important role of the action research stressed by Allison is that the researcher takes some specific action to improve practice and feedback outcomes from the enquiry as it goes along and thus becomes able to influence practices in a formative way (also referred in chapter 7. as *evolutionary prototyping*).

Before discussing how each method of data gathering used in the current research, it is important to examine terminology used for questionnaires on surveys and interviews that are constantly used throughout this thesis.

For questionnaires, the word *item* is used in preference to question because the request for information is often not phrased as a question (Allison et al, 1996). In general, the items involved in research questionnaires can be *fixed alternative* or *open-ended.* In fixed alternative items, the respondent is required to choose from four or more predetermined alternatives for example from agree to disagree or from always to never. Often a scale format, which allows the respondent to register degrees of agreement or disagreement in an item, is used in such a type. The main advantages of this type of items include that they are easily coded for statistical computational analysis, they produce greater uniformity and inferentially greater reliability because respondents are forced to select one of the responses available. A disadvantage can be considered as when none of the alternatives given appear to match the respondent's view. This may result in inappropriate, inaccurate or misleading responses. In such cases the word 'other' used as a solution to ease this problem, by allowing the respondents to add in the scale values given. *Open-ended* items on the other hand, allow the respondents to take the initiative in expressing their opinions or feelings to a given question without this being forced into categories or options. A major drawback of such type of items is that it is often difficult to record adequately the responses and to code or to attach a numerical value to them (Allison et al, 1996).

The study used interviews that are *structured* and *semi-structured* based on an *interview schedule* (checklist). Structured interviews are conducted according to a pre-arranged plan, helping researcher to control the pace, structure and content. *Semi-structured interviews*

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[4] See Brian Allison, An Introduction to Research, 1993 30-35

where there are pre-arranged questions, but the researcher deliberately leaves some freedom to the respondent to change the pace, structure and content of the interview. *Interview schedule* is a series of questions, along with supplementary notes, devised before an interview, to remind the researcher of the questions to be asked (Oliver, 1997: 187). For model testing the sampling approach for interviews include *elite interviews* in which those interviewees selected are individuals who are assumed to have special insights into, and knowledge of, the topic concerned, such respondents are called *key informants.*[5]

The *interview schedules* includes a questionnaire form with *open items* when the interviewee is required to give the answer in whatever form the subject wishes and *closed items* for which the interviewee is required to select from a range of presented answers (Allison, 1994). Most frequent *closed items* are relevant with the respondent expertise, year of experience, companies' activities or when is easy to pre-determined the options that answers may include for example: *Do you have an environmental policy?(scale alternatives from always to never)* or *Do you have an environmental manager in place?(Yes/No)* Data were *pre-coded* where it has been decided in advance the categories and concepts that are included in the questionnaire and *post-coded* where the categories and concepts are suggested by the subject, and the researcher builds upon them (Oliver, 1997: 129).

3.4.1 Surveys

Two surveys were conducted during the progress of the research, aiming to collect a variety of data by means of a single questionnaire from a representative sample of the target population.

The first survey was conducted during the preliminary study with the aim of identifying attitudes towards environmental management systems and environmental claims related with packaging design. The basic intention of the first survey was to identify issues where more research was required and to generate specific questions for further researching. The survey consists of one page self-completion questionnaire distributed by hand. The items included in this questionnaire were fixed alternative, with five-point scale format for example from 'Strongly agree' to 'Disagree strongly' including mid-point. Subjects' responses to the scaled fixed alternatives were easily transformed into quantitative data for computerised statistical analysis.

[5] Oliver P., 1997, Research for business marketing and education, Hodder & Soughton Ltd, London, p. 120

Investigation Stage

Formulation of the hypothesis

Data collection

Qualitative research

Choice of contacts the survey:

1. Computer Web Page; publicise the survey in design magazines
2. Telephone & Postal

Topics of interest

Population of interest

Considerations regarding the conclusions, the time available and sufficiency of the data

Designing the questionnaire

Decide the level of generality of topics and the number of responses required for qualitative analysis of the results

Plan of Tabulation

Ordering of topics | **Format of the topic**

Formatting and defining the items to be included. Consistency of results as a part of building the final *model*. Decide direct/indirect items. Open/closed items. Pre-coding.

Questionnaire Layout

(see appendix IV)

Piloting the questionnaire

Piloting the questionnaire in different stages with the aim to rearrange the format and the type of the items in order to confirm validity avoid mistakes and ensure the use the appropriate items that would bring useful results for the study.

Testing- Probability Random Population

(feedback from environmental consultancies, designers and companies worldwide)

Factor analysis.[6]

Evaluate the findings -

Optimise the quality of the information contents the order and the efficiency of the questions.

Modifications

Main survey

Conducted it through the members of the Institute of Packaging (Membership category: Consultants; Packaging designers; Paper packaging companies; Paper suppliers;) Total sample population 64.

For a complete analysis see appendix V. Second Survey

Quantitative research

Cluster analysis[2]

Table 3.1 Development stages of the principal survey

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[1] Factor analysis examines correlations between variables across respondents;
[2] Cluster analysis looks for correlations between respondents across the segmentation variables. (Crimp M:1985, p 115)

The second survey presented under the heading of 'principal investigation' aiming to test theories related to auditing methodology for packaging. In addition the second survey was expected to reveal new insights, knowledge and understanding in the area of environmental management systems within product design (packaging). The survey was piloted through a web page design in design and environmental consultancies, environmental organisations, environmental and design researchers and packaging companies. A self-completion questionnaire was used, that consisted of four sections which covered from personal views on business environmental debate to issues related with the corporate environmental profile and environmental management approach. The main survey conducted in UK packaging companies, suppliers and design consultancies, distributed by e-mail or by post a cover letter included and a SAE was supplied where applicable.

The items included in this questionnaire were fixed alternative, with vary point scale format including a mid-point and open-ended items. The responses to the scaled fixed alternatives items were transformed into quantitative data and analysed by a statistical computer programme. The results from the open-ended items analysed by employed content analysis. The Table 3.1 illustrates the development stages of the second survey.[7]

3.4.2 Interviews

According to Oliver (1996: 111) one of the most significant aspects of the interview is that *'it produces data of a detail and richness which it is difficult to acquire in any other way'*. To support the structure of the research process three phases of interviews were conducted as shown in the table below.

Research Stage	Aim	Type
1. Explanatory Stage: *Phase B.*	Evaluating methodology for environmental labelling and environmental auditing with regards to packaging design	Semi-structured
2. Investigation Stage: *Phase A.*	Evaluation of the five different prototype formats of the *model* of environmental analysis	Structured
3. *Model* Testing and Evaluation Stage	Evolutionary prototyping and evaluation of the final format of the *model* of environmental analysis.	Structured and Specific Interviews

Table 3.2 Overview of Research Interviews

The following up activity of field research at the *formulation stage* of this research was to conduct all relevant private and governmental organisations in UK and EU and some in

USA involved in packaging and environment; environmental issues and design and all environmental labelling bodies worldwide. A letter was sent which addressed specific research questions and a page with the project description was included. The observation and evaluation of data collected from this stage of the research generated different hypotheses paths to be explored in a more detailed study at the next research stage.

During the stage of the *explanatory* study the first round of the interviews conducted aimed to identify knowledge and understanding related to environmental management systems; environmental labelling; and environmental product design. The additional aim of that phase was to formulate specific research directions enable the researcher to prototype different options (models) that addressed and assessed the environmental performance of paper based packaging. Packaging companies and environmental and design consultancies were selected to be interviewed at this stage.

At the *investigation* research stage the second round of interviews aimed to give answers to specific research questions and test the progress of the development of the model. Five different formats of models of environmental analysis were presented accompanied with a pre-planned questionnaire. Such questionnaires (called by the researcher *attitudes questionnaire*) aimed to identify attitudes towards addressing different methods of environmental analysis. The same interview schedule was used for the five different formats of the model. This group of interviews was conducted in UK packaging companies, environmental and design consultancies and environmental and packaging private and governmental organisations in UK and Europe.

The third round of interviewees were chosen for a more detailed study and testing the final format of the *model* of environmental analysis and to validate some of the research outcomes within a specialised audience. In that phase some of the interviews were team interviews where more than one interviewee was presented during the session. The third phase of interviews include testing the model in UK packaging companies that have identified from the second survey as 'environmentally active'; that means held an environmental policy and/or applied environmental principles to their product design. Also interviews were conducted with relevant environmental bodies in UK. The interviews were achieved through participant observation, the researcher was an 'observer as a participant', i.e., a spectator in an overt research (see Gill & Johnson 1991: 112 and Hammersley & Atkinson 1993: 88-104).

The interviews were structured and open, semi-structured,[7] this mean that apart from the free discussions, checklists were used to guarantee that all relevant information was collected. At the end of the interview respondents were given the opportunity of elaborating and adding to their views. Interviews were conducted by face-to-face or by telephone. Face-to-face interviews were supported by subsequent informal discussion, telephone conversations and correspondence, which gave the interviewees a chance to supplement the information they had provided earlier and go in detail to those areas they found most important.

The study found interviews as an essential source of information material and in order to collect a good number of interviewees most of the interviews conducted by phone. The costs for travel expenses and time limitation to complete the project considered as additional reasons to conduct interviews by phone. Also, some of the people contacted with the request to arrange a face-to-face interview said that they did not have the time available to arrange it, but they were willing to offer some of their time to be interviewed on the phone. Filder (1994) found telephone interviewing appears to have a great deal of potential for research in particular, he states:

> "The advantages of quicker results and a higher response rate compared to postal questionnaires, and lower costs, lower interviewer bias and improved geographical coverage compared to face-to-face interviews, make telephone interviews worthy of consideration."[8]

Telephone interview lies on a spectrum of data collection methods between postal survey and face-to-face interviews. Filder (1994: 284) sees telephone interviewees lies between the two in terms of (a) *cost* and (b) *response rate*. He identifies an important advantage to be the *'speed'* in obtaining results. On the issue of data quality, there has been a reappraisal of the value of telephone compared to conventional interviews. Cannell (1985) comments that: *"while we think our enthusiasm for telephone was in the first place mainly financial, we are now coming to the conclusion that this may be an inherently better way of collecting data"*.[9] Indeed, Lavrakas (1987) argues that one of the biggest advantages of telephone interviewing is the ability to control quality throughout the process: "*when properly*

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[7] See: Oliver, 1997: 111-121; Allison et al., 1996: 27-43 and 100-101; Mantwill at al., 1995: 68-69; Filder, 1994: 283-289; Wragg, 1994: 267- 282; Patton, 1990: 10; Strauss & Cobin, 1990, 18; Yin: 1989: 19; Cohen: 1989:7; Bryman 1989: 149

[8] Filder, B. (1994) Telephone Interviewing. in Beed T.W. and Stimson R.J. (eds) *Survey interviewing: theory and techniques.* Sydney, NSW: Geo Allen & Unwin. p. 288

[9] His comments are based upon comparisons of large-scale studies in the USA on telephone interviews versus interviews on medical matters which showed great similarity in the findings. See: Cannel, C.F. (1985) Interviewing in telephone surveys, in Beed T.W. and Stimson R.J. (eds) *Survey interviewing: theory and techniques.* Sydney, NSW: Geo Allen & Unwin. p. 70

organised, interviewing done by telephoning most closely approaches the level of unbiased standardisation that is the goal of all good surveys".[10]

Summarising a number of writers much of the success of telephone interviews depends on three norms provided by Frey (1989) which states that when a call is made, each respondent feels: 1) an obligation to answer; 2) an obligation to negotiate termination; and 3) a pressure to carry on an active conversation.[11] Telephone interviews followed an interview schedule and a pre-arranged plan with minimum deviations. The potential interviewee was contacted by phone from a mailing list (produced by the researcher for each stage of the interviews) and asked if he/she wants to participate in the research and arrange a time and day that the researcher will call back to interview him/her. The aims of the research were explained and the promise of a summary results of the main research findings in relation to the request was given in order to prompt the interviewer to participate. Then, a project description send it to him/her with the interview questions and a covering letter remind him/her of the date and time of the interview.

The main disadvantage of telephone interviewee is that communication is limited to verbal and paralingual utterances. Sykes and Hoinville (1985) recommends that complex questions can be aided by posting copies of visual aids before telephoning. Although, they stated that evidence on the acceptance degree of question complexity without visual aids is reassuring.[12]

For *model* testing the interviewee received in addition of the questionnaire, copies of the different *models* to be tested. When the time given from the interviewer was not adequate enough to cover all the aspects that the research intended to do, the interviewer requested to send back written comments or/and the questionnaire completed; a SAE was provided on such occasions.

To help the analysis all face-to-face interviews and some of the telephone interviews were tape recorded. Hand notes also, held during the session by the researcher and for telephone interviews a questionnaire used that completed by the researcher during the session or by the interviewer in a later stage (by post). The length of face-to-face interviews were from one hour to one and half hour approximately in some occasions this extend to two hours or more. Telephone interviews occurred in an average time of thirty minutes (from twenty minutes minimum to forty five or fifty minutes maximum).

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[10] Lavrakas, P.J. (1987) Telephone survey methods: sampling, selection, and supervision. Newbury Park, Cal: Sage p. 12
[11] Frey, J.H. (1989) *Survey research by telephone* (2nd ed.), Newbury Park, Cal: Sage .
[12] Quoted from Fidler, B. (1994) Telephone Interviewing. Chapter 9. in Bennett, N. et.al., (eds) *Improving Educational Management through Research and Consultancy*. The Open University. p.285

3.4.3 Model Formulation and Testing

The methodology used to formulate and test the model of environmental analysis followed the stereotype approach of hard systems methods. Waring found that: *"hard systems methods share a common approach to problem solving that has evolved through cross-fertilisation of ideas and practice"*. This approach comprises the following nine stages (Waring, 1989, pp. 56-61):

1) *Groundwork* - identifying the problem set and its world-view.
2) *Awareness* - gaining awareness and understanding of the problem.
3) *Goals and objectives* - establishing overall goal and set objective (the position to be reached; constraints to be contended with).[13]
4) *Measures* - finding ways to reach objectives (creative, divergent thinking followed by structural focusing on a range of practical possibilities).
5) *Models* - test possible options against measures of performance.
6) *Evaluation* - assessing the likely outcomes of each option under a range of possible conditions; testing credibility with client set.
7) *Making a choice* - selecting the route that best meets the objectives given the constraints and prevalent world-view.
8) *Implementation* - putting the solution into effect; may required further systems design work.

The formulation of the *model* of environmental analysis followed the stages described above. The first survey and the first phase of interviews from the explanatory stage of this research study, establish the goals/objectives and measures and enable the researcher to formulate the first format of the *model* that evolved through interviews within a specialised audience. The evaluation of the findings from interviewees formulated the second format of the *model* and evaluated again through interviewees with experts. Five formats of models of environmental analysis were formulated in the same way. For reliability reasons each format of the model was presented at international design and business events, before being tested within the specialised audience. It was found necessary to report the work in progress as a part of the observation methodology.[14] In that way the researcher became able to test out themes; make modification of the *model* and improve the quality of the research. To enable the researcher to collect data across the target population, for inclusion in the final

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[13] Note: according to Waring in hard systems approach 'goal' represents the overall target, whereas 'objective' is a *measurable* contribution to the goal.
[14] Observation is an essential part contributing in the methodology of action research. According to Seashore observation methods include the empirical clarification of concepts, techniques for obtaining data

model the second survey was conducted and presented under the heading of 'principal investigation'.

Observations require explanation but equally according to Vaus (1996/1985: 11,17) their explanations need to be tested against the facts. Vaus believes that it is not enough simply to collect facts, nor is it sufficient simply to develop explanations without testing them against the facts. Vaus also comments that the development of a good explanation involves two related processes *theory construction* and *theory testing*. The data collected and the observations in every phase of model formulation - each phase represents the five different prototype formats of the model - enable one to construct a theory against further testing as required.

The *model* developed in different phases is based on the information and material collected mainly from interviewees and the second survey. The collected information has been evaluated; categorised; modified; formatted (model stages); piloted; and tested. The study found as a more appropriate method of testing (repetitively) the different formats on the development of the model the use of interviews. This testing is a part of the action research that has a critical evaluative element and is most often undertaken in collaboration with others (Allison, 1994: 35). The participants include: environmental consultancies, design consultancies, design managers, environmental managers in packaging business sector; environmental governmental and private bodies; design and environmental organisations and researchers from industry and educational environment.

Evaluated Objectives	Evaluation Method	Data Type
Performance	Multiple-choice questionnaire used in Interviewees sessions	Quantitative
Effectiveness in use (apply in different model formats)	Second Survey	Quantitative
Acceptance (apply to the final model)	Attitude Questionnaire Structure and *Elite Interviews*	Qualitative/Quantitative Qualitative

Table 3.3 Evaluation toolkit for model testing

The evaluation of the different formats of the *model* was conducted through the use of *multiple-choice questionnaires* and the *second survey*. The final format of the *model* was evaluated through the use of *attitude questionnaire* disseminated by telephone interviewees across the target population and by the use of interviewees with *key informants*. The evaluated objectives of the different formats of the *model* were to discover the

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and testing their conceptual and relational properties, development of standard instruments and procedures, and recording methods. (See Clark, 1076: 112, 103-117)

performance in terms of understanding of the qualities of the model and the effectiveness of its use and for implementation of the final model the evaluation objective was targeted *acceptance* in terms of a working model.

3.4.4 Experimental Case Studies

According to Yin (1991: 16-20) the case study method is an empirical research which examines a contemporary phenomenon in its real life context when the boundaries between the phenomenon and the context are not clear, and when several sources of information are used. Yin recommend the case study method as particularly suitable in situation when 'how' and 'why' questions are asked about contemporary events over which the researcher has no control. Case studies used by this research in the final part when the *model* has been formulated with the aim to demonstrate the potential practical role of the *model* in a real situation, preparing the ground for future research.

Bell (1993: 8-10) suggest the case study is suitable with concerns about the interaction of factors and events. She does not exclude any method for collecting information appropriate for the task, although she found observation and interviews in most use as case study method. She commented that even if the majority of the case studies are carried out as free-standing exercises, the case study may be carried out to follow up and to put flesh on the bones of a survey. The second survey was used in this study not only as a means of identifying key issues to include in the formulation of the model, but also as a way to identify appropriate companies and products that it would be of a value to explore as case studies.

The number of the case studies was decided as proof of the validity and reliability of the future recommendations. If just two case studies have been chosen it would not leave enough reassurance about the accessibility of the model as Mark John from the UKEB Ecolabelling Board comment on the interview (May 1997). The initial data was collected through interviews, discussions and observations as well as through the study of official and unofficial documents, all of which are the basic ways of gathering information for a case study (Yin 1991: 83-95). The three (mini) case studies are presented in detail in Chapter 8.

3.5 The Validity of the Methods

With the aim to improve the quality of the research special attention was given to construct internal validity, external validity and reliability. The internal validity refers to the possibility to establish a causal relationship between research constructs and touches upon issues of precision and significance of empirical, action research (Yin, 1984/1988: 40,

42-43; Weick, 1969/1979: 35-36; Thorngate, 1976: 406). The external validity[15] refers to the possibility to generalise findings on a researched population across other populations, ideally to populations as they can found in the real world. Issues related to the relevance of the research with pragmatic situation are touched upon (Coolican, 1990: 36; Yin: 1984/1989: 43-44). The reliability refers to the possibility that a study can be repeated by another researcher yielding the same results (Yin, 1984/1989: 41,45; Coolican, 1990: 34). Allison sees reliability as an instrument which continually produces the same result when applied in identical situations on different occasions.

In order to strengthen the construct validity, three methods were utilised: multiple sources of evidence, key informants' reviews and chain of evidence. To manage internal validity the findings from different research activities are matched; compared; and contrasted. To increase external validity of the research, multiple sources and cross reference of the information material (research findings) are used. While reviews and revisions of the key findings meant to be in the part of building a chain of evidence constructed the research outcomes. The use of multiple sources of evidence include human interaction and data type (literature sources). Several people have been contacted on the same topic confirmed some of the data collected as validated. Also in that way different views brought up for the same topic based on the persons' position and knowledge. Interviews and discussions were supplemented by unofficial and official documents which also both confirmed and questioned the data collected earlier.

The valid information is that which describes the factors, plus the interrelationships, that create the problem for the client system. There are several tests for checking the validity of the information. In increasing degrees of power they are public verifiability, valid prediction, and control over the phenomena (Argyris, 1970; see also, Campbell, 1970; Stanley, 1970; Rasmussen, 1990). To test validity (external, internal) and to improve the reliability of the research different forms used in the part of the descriptive research such as surveys; comparative studies; correlation studies; cross- sectional studies, case studies. And in the part of the action research interviews multiple-choice and attitudes questionnaires for *model* testing.

The validity and reliability of this research are functions of the approach followed by the philosophical paradigm. The reconstructive paradigm cannot provide validity by technically checking whether the research instrument measures what it is supposed to measure as it

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[15] The notion of "ecological validity" is a synonym for external validity.

attempted within the positivist paradigm. The positivist idea of proving reliability ensures that measuring and testing provide the same results on different occasions. The chosen ways of improve validity and reliability of this research strive towards these goals.

However, reconstructive paradigm has an aspect that is not accepted in traditional paradigms. Reconstructive paradigm maintains that if reconstructive science is based on empirical evidence, and if that evidence changes through the results of further research, the claims of reconstructive science also have to change (Rasmussen, 1990; see also Habermas) The general criterion within the reconstructive paradigm is whether the researcher has gained full access to the knowledge and meanings of the informants (Ketola, 1996). Habermas sees the element of reconstruction paradigm, that maintain changes in the research on the basis of new evidence, as an opportunity to develop his ideas, rather than a threat to reliability. This aspect of reconstruction paradigm considers the model building (chapter 7 and 8) and conclusions (chapter 9).

The data has been categorised (based on the information contents) under the label of information material contributing to the creation of the final *model*, that formulated after repetitively testing on specialised audience. The information material presented in the different chapters and conclusion appear at the end of each chapter related to the observations and evaluation of the findings.

3.6 Process analysis and evaluation of the results

Data collected from different sources and cross reference system used to avoid replication of the information. Accounts of the procedures, size of samples, method of selection, choice of variables selected can be distinguished as a quantitative approach that draws on techniques such as experiments, surveys, histories, analysis of archival information and a qualitative approach that utilises techniques such as observation, open interviews, etc. (see Patton 1980/1990: 14, 36-39, 162-166; Yin 1984/1989: 17-22; Bogdan & Taylor 1975: 3-7; Vinehall 1979: 108-115)[16]

The labels 'quantitative' and 'qualitative' used by this research, are largely equivalent to the labels 'objective' and 'subjective' (distinguished by Burrel & Morgan, 1979: 1-8). Both the quantitative and the qualitative approaches are used to analyse and evaluate the data. Quantitative and qualitative studies acknowledge different trade-offs regarding validity,

[16] The quantitative approach tends to be related to logical positivism, the traditional empirical research paradigm of the natural science. The qualitative approach relates to a phenomenological, hermeneutic research tradition that originated in the social sciences (Day & Castleberry, 1986: 94-95; Bodgan & Taylor, 1975: 2,14)

external validity and reliability.[13] Quantitative methods through their strict control and manipulation of the research environment tend to have an edge over qualitative methods with regards to internal validity and reliability (Stoecker, 1991: 91; Cohen, 1989: 13). However according to Coolican (1990: 237) external validity is likely to be higher in quantitative research since the context and the phenomenon under investigation are not artificially separated (see also Cohen, 1989: 13).

The qualitative approach that it is taken by this study examines methodological issues relating to how and from whom data is collected. It deals with the selection and evaluation of data collection techniques, its application to research on environmental management systems within product design and how to sample interviewees; conduct the surveys; and select the event for research presentation and the experience of the interviewers to whom each format of the *model* is presented to secure external validity and reliability. While case studies selected as a method of re-informing internal validity and reliability.

To analyse qualitative data Easterby et al (1994: 334-335) introduce two ways, the 'content analysis', where the researcher 'goes by numbers' and 'frequency' and, secondly the 'grounded theory' where the researcher goes by feel and intuition, aiming to produce common or contradictory themes and patterns from the data which can be used as a basis for interpretation. The research used both methods for analysing data *content analysis* used for example in analysing open-ended items from surveys and interviews where *grounded theory* is used to produced observations combining the results from different research activities.

3.7 Summary

This chapter has explained the framework and methodology adopted for this research in order to achieve the new model for environmental analysis. The next four chapters explain the logical application and outcomes of the stages set out in section 3.2.

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[13] See Stoecker, 1991: 92-93; Coolican, 1990: 34-38; Patton, 1990: 14; Bruner, 1979: 2-3; Weick, 1979: 35-36

CHAPTER 4. EXPLANATORY STAGE *Evaluating methodology for environmental labelling and auditing with regards to paper packaging products*

4.1 Introduction

This chapter presents the activities and the results which occurred at the explanatory stage of this research study and includes the first survey investigating the use of environmental auditing and LCA for packaging. Also, findings from semi-structured interviews investigating the methodology for environmental labelling and auditing with regard to paper packaging products are discussed. The evaluation of the findings from this research stage generate specific research directions that aim to be explored in the next stage of the research.

4.2 Explanatory Stage *Phase A.*: Preliminary Survey

During the explanatory stage of this study a survey was conducted with the aims of identifying attitudes towards 'misleading' environmental claims and testing respondents opinions about the use of Eco-labelling award schemes and assessing methodology in the use of environmental auditing for the packaging business. Furthermore the survey aims to gather relevant information regarding a particular enquiry, that is - *if the development of Life-Cycle Analysis and Eco-Assessment as a part of Eco-label schemes for paper packaging products will assist packaging businesses.*

Formulation

The survey was conducted among the participants of two events, following formal presentation of the research study and the aim of the survey.

1. '1995 - East Midlands Region Environmental Conference', The Nottingham Trent University, 12th .July 1995
2. 'Eco-Design Seminar', The Manchester University, 20th October 1995

The establishment of the survey was organised in three stages. Firstly permission was asked from the organisers of the events to conduct the survey, and to allocate a minimum of ten minutes presentation so the researcher has the opportunity to explain the intentions of the research project and the aim of the survey. The second stage was to distribute the self-completion questionnaire by hand to the participants and thirdly discussion and questions about the research topic took place.

Participants

Sixty professionals took part in this investigation. The subjects' respondents were from

design and business schools - such as lecturers (eighteen) and postgraduate research students (four) - and also from the business environment related to packaging (twenty); environmental consultancies (two); and professional researchers (sixteen).

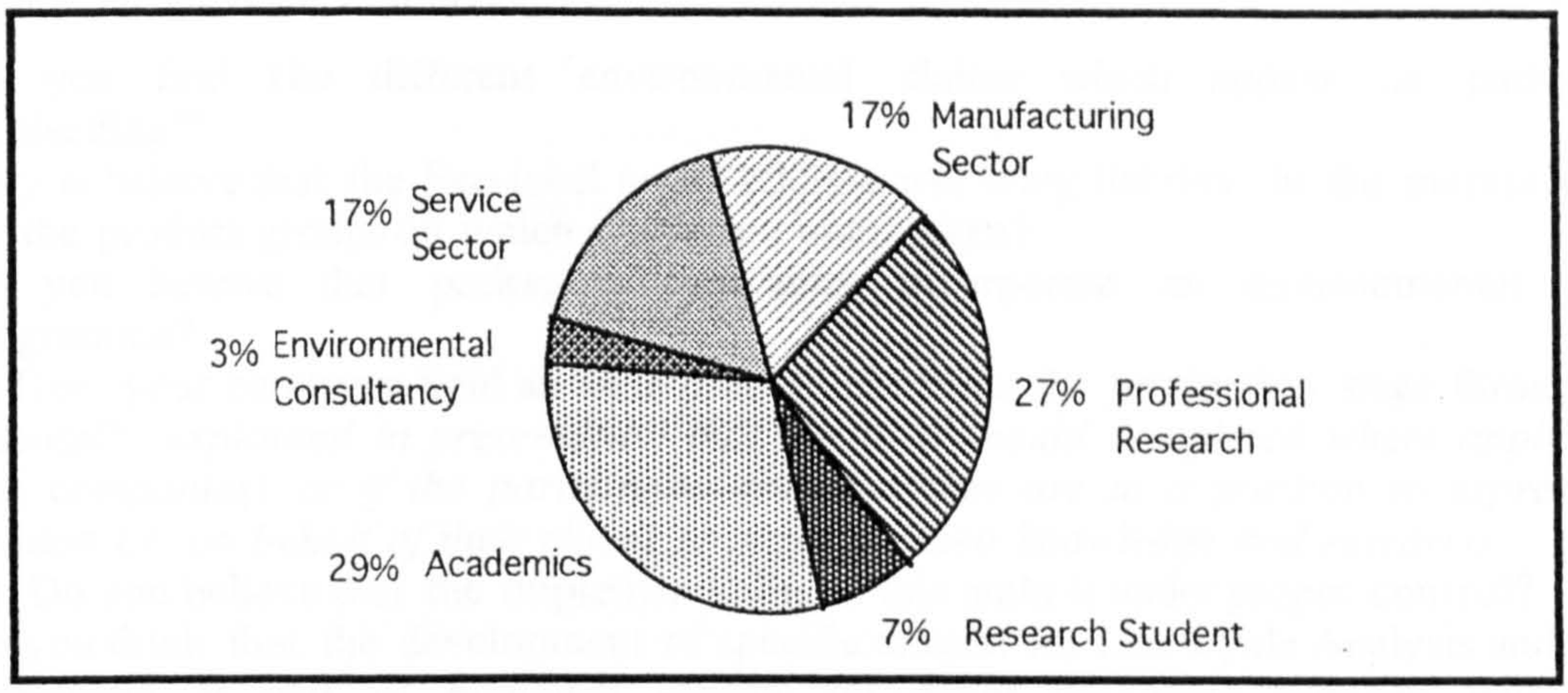

Figure 4.1 Business activities of respondents in first survey

The audience of the two events above were selected because there are specific questions in the survey aiming to investigate current attitudes in the development of LCA and auditing methodology for packaging. These questions apply both to business and educational environment, for reasons such as:

1. To investigate attitudes in packaging business about environmental activities in practical applications. The interviews at the second phase of explanatory study target specifically packaging business.

2. To select opinions from academic environment and professional researchers - academics and postgraduate students were mainly from design schools, academics were also from business and management schools subject related with business environmental performance. Professional researchers were from the area of eco-design. Those subjects' respondent were in a position to provide information about current affairs and research in the area of LCA; eco-auditing and packaging relate to their work and experience.

As there is no previous survey specifically conducted for such an audience, their opinions were considered valuable. There is a good number of consumer surveys investigating attitudes towards environmental claims on products (for example Eurobarometer consumer research 1994; MORIS research 1995; National Consumer Council research 1996). The interviews which follow in this chapter were conducted with packaging design environmental practitioners and their answers compare and contrast with the findings from the preliminary survey.

Instrument

The instrument used in this investigation was a self-completion questionnaire (see Appendix I). The questionnaire consisted of six items with four or five-point scaled alternatives. In

addition the first item include a provisional item placed as request asking the participants to provide an example of misleading environmental claims and comment on it, aiming to enable the researcher to collect examples of the use of misleading claims.

The items included are as follows:

1. Do you find the different environmental claims which appear on packaging 'misleading'?
2. Do you believe that the Eco-label award scheme will bring liability, in the market place for the product groups on which studies are undertaken?
3. Do you believe that packaging companies incorporate an environmental audit programme?
4. **A)** Does your company hold an audit programme from the production stage through to disposal? - *explained in presentation that this item should completed where applicable (i.e. companies) or if the participants feel that they are in a position to express an opinion i.e. on behalf of their clients or based on their knowledge and research*
   B) Do you believe that the implementation of this audit is under proper control?
5. Do you think that the development of specific criteria for Life Cycle Analysis and Eco-assessment as part of Eco-label scheme for paper packaging products will assist packaging business?

The instruments use in this survey include three acetates that have been prepared for the ten minute presentation of the research and the aims of the survey and, a handout that was given to the participants describing the research project and giving the contact address of the researcher to maintain further communication as requested at the end of the session.

4.2.1 Results

In order to analyse the responses of five and four scale items selected values were assigned to each of the answers, starting from the value '1' where the agreement or sequence was strongly or often equivalent, to value '5' where the respondent disagreed or the event described on the item never occurred, the value '6' was assigned to describe the non-respondents. The complete analysis is presented in Appendix I: *Index First Survey - Data and Statistics.*

Professionals (including designers), researchers and educationalists in the area of environmental issues and packaging design and manufacture found environmental claims appearing in packaging misleading most of the time (38 subjects' respondents). A further one fifth of the respondents indicated they found the claims misleading half of the time. From a sample of 60 responses none indicated they did not feel 'mislead' to some degree. Among other comments on the first item about the 'misleading' content of environmental information on packaging products subjects' respondents said : *"too many to mention 'biodegradable', 'environmentally friendly', etc. very vague"* (Researcher, University of Nottingham); *"100% recycled paper is not always post consumer waste. The public don't*

understand this"[1] (Research Assistant, Crandfield University) *"Products (e.g. washing powder) claim not to contain a chemical which they never contain anyway"* (Lecturer, De Montfort University) *"doesn't contain phosphates, the product never did"* (Ecodesign Researcher, The Open University), *"the packaging often claims to be recyclable with no clue as to how they do it e.g. plastics or say recyclable when it means made from recycled materials"* (Environmental Officer, Nottingham), *"environmental friendly - to whom or what? what does it mean?"* (Engineer), *"Use of recycling logo to mean recyclable"* (Designer).

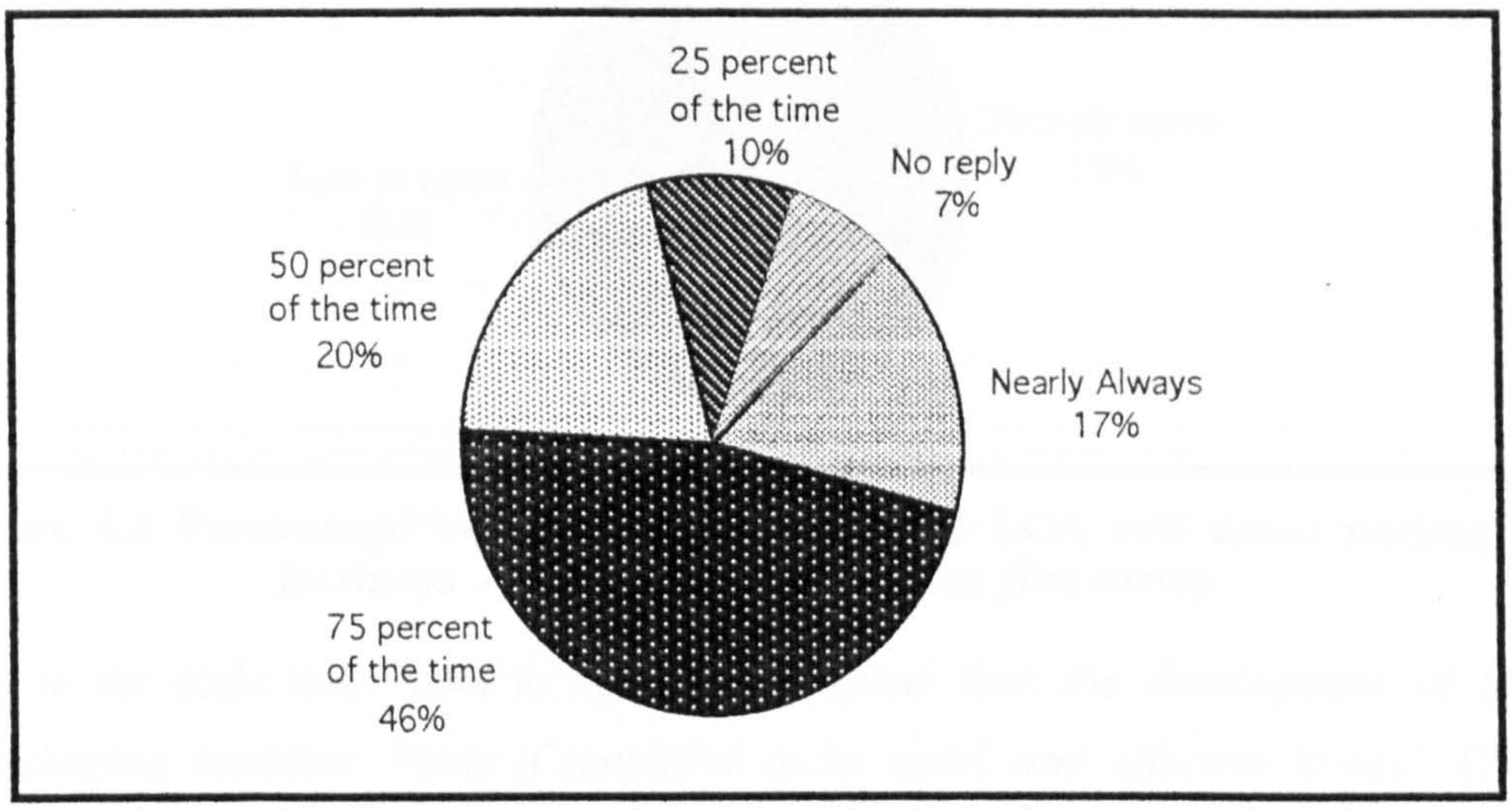

Figure 4.2 Frequency of 'misleading' environmental claims
- Subjects' respondents in the first survey

Frequency of distribution

The findings based on the frequency of replies in each item, give the following results:

⇒ Most of the respondents (on item 1.) believe that environmental claims appear in packaging are misleading (84 percent) and a 53 percent believe that the Eco-label award scheme will bring credibility in the market place for the product groups on which studies are undertaken (subjects' respondents on item 2).

⇒ Only a 5 percent (3 subjects' respondents on item 3) believe that packaging companies incorporate an environmental audit programme *nearly always*, while the biggest percentage of 36 respondents (60%) believe they *seldom* carry out an audit.

⇒ Subjects' respondents on the scale item 4a) believe that packaging companies hold an environmental audit programme that reviews the LCA stages of a product with 14 percent believed frequently and 15 percent *hardly ever*. In addition, 33 percent believe that the such audit is 'hardly ever' under proper control (subjects' on item 4b.) The no reply answer on both items (27 subjects' respondents) considered as not applicable. The percentage of those

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[1] He wants to say that 100% recycled paper might be made from mill broke and not post consumer waste.

that they did not reply is mainly because the question was not applicable to them i.e. 'students' and 'teaching'.

⇒ 65 percent of the respondents 'tend to agree' with the item 5. that the development of specific criteria for LCA and eco-assessment as part of eco-label scheme for paper packaging products will assist packaging business (see figure 4.3).

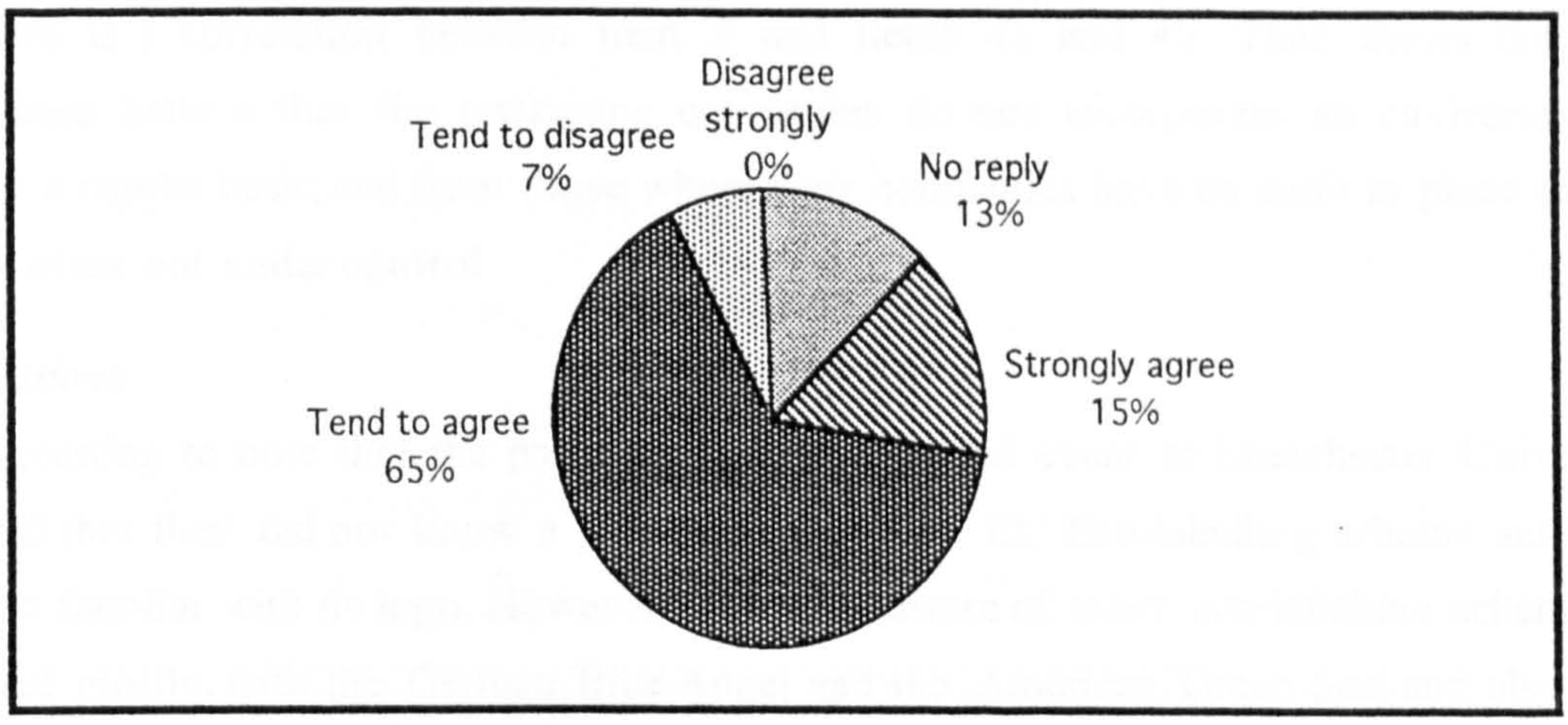

Figure 4.3 Percentage believing development of LCA will assist packaging business - *Subjects' respondents on first survey*

Subjects' to the scale item *'tend to agree' commented that: the development of LCA will assist packaging business "only if simplified to be quick and effective to use"* (Research Assistant) and, *"LCA in order to indicate areas of environmental impact but have doubts about the usefulness of a very in-depth LCA for 'visual' people like designers. Good to indicate particular strategy for the company"* (Eco-design Researcher).

In general terms any product that is not supported by independent scientific verification may be challenged by government or consumer groups for the truthfulness of each claim.

Correlation studies

The main findings from cluster analysis of the correlation between the category and items (see Table I.9. on appendix I) bring the following conclusions:

⇒ There is no relation between business activities and replies.

⇒ There is a high correlation between item 1. regarding the 'misleading' use of environmental claims on packaging; and item 2. about liability in the market for products that carry the Eco-label; thus identifying those people who believed those there is a high frequency on 'misleading' environmental claims on packaging and also tend to believe that the use of Eco-labelling award scheme will bring credibility in the market place.

⇒ There is also a correlation between item 1 and item 5. Subjects' respondents who believed that there is a high frequency on 'misleading' environmental claims on packaging

tend also to believe that the development of Life-Cycle analysis and Eco-assessment for paper packaging products as a part of Eco-label scheme will assist packaging businesses.

⇒ There is a high correlation between question 2 and question 5. Participants who believe in the use of Eco-label as a legal binder for environmental claims in packaging also believe in the development of LCA for paper packaging products under the Eco-label scheme.

⇒ There is a correlation between item 3 and items 4a and 4b. That shows that the respondents believe that the packaging companies do not incorporate an environmental audit on a regular basis; and from those where their companies have an audit in place that it is most often not under control

Observations

It is interesting to note that the participants in the second event at Manchester University indicated that they did not know a great deal about the EU Eco-labelling scheme and they were not familiar with its logo. However some were aware of other eco-labelling schemes in existence mostly with the German Blue Angel and the American. Green Seal and also with packaging recycling/recyclable and reusable symbols that are common in use (see EU Packaging and Packaging Waste Directive OJ No C137/65). The same finding came from the analysis of interviews with packaging companies which follows - comments indicated that literally many respondents have never come across the EU Eco-label flower logo. Surveys conducted with consumers by the EU Competent Eco-labelling Body in UK (Newsletter 1996) came up with the same results. While the National Consumer Council (1996) found consumers unaware and confused by plethora of on products environmental claims including labelling.

Another remarkable observation is that even if subjects' respondents in the survey were not all business people but researchers and academics one may suppose correctly that they may not be in the position to know if packaging companies incorporate or holds audits - directly at least - although they might know indirectly as they deal with issues surrounding business environmental performance, design and packaging by teaching or researching - and cross-examination with findings from interviews (see explanatory stage: Phase B.) brings the same results.

Finally, even though the questionnaires were collected by the researcher at the end of the sessions, participants responded to the request for sending information and materials such as official, unofficial documents from their companies and recommendations for further contacts have been made.

4.3 Explanatory Stage *Phase B.*: Evaluating methodology for environmental labelling with regards to paper packaging products

Phase B. of the explanatory stage of the study includes research interviews associated with packaging companies' environmental activities. Those interviews were divided into two *inter-related* stages: first current attitudes about the use of environmental labelling for paper packaging products, and second (in 4.4.) the methodology for environmental auditing for paper packaging products is examined.

A summary of the aims of the first stage of interviews is presented below:

1st Evaluate methodology for environmental labelling with regards to paper packaging products.

2nd Generate hypotheses paths about environmental labelling for paper packaging products that can be examined and evaluated at the second stage interviews.

3rd Create considerations for the new model of environmental analysis.

Formulation

The *interview schedule* includes three sections firstly, the introduction where the aims of the research project and the interview are explained to the participant. The second section asked the respondent to specify the business activity and the size of their corporation for the purpose of the analysis. Thirdly, the questionnaire includes nine open-ended items. The *interview schedule* follows a semi-structured format as it allows respondents to express themselves at some length, but has enough shape to prevent aimless rambling.

The sample selected from *The Institute of Packaging Directory and Review 95/96* and, *Design Business Association 'Directory of members 1995/96'*. The sampling method can be classified as *stratified* by dividing the target population into homogenous groups based on their business activities such as a) Paper/Board Suppliers, b) Paper products and packing Manufacturer, c) Packaging Retailer *Contract Manufacturing* and, d) Consultants Packaging Design. The sample aimed mainly for groups a., b. and, c. from where the biggest number of population come from.

Participants

Eighty four subjects took part in this investigation. From the eighty four respondents seventy were interviewed by phone out of the total of one-hundred and thirty contacted to be interviewed and, fourteen face-to-face. From the seventy interviewed by phone, thirty four were Packaging Designers, thirteen Packaging Engineer/Technologists, nine Packaging Development Managers/Directors, five Packaging Quality/Assurance/ Control Managers,

eight Packaging Commercial Managers and, one Packaging Environmental Consultant. The sample was from UK based companies, with thirty two having 50 to 90 number of employees, twelve 1 to 49, twelve with 100 to 249 followed by six with 250 to 499 and six with 1000 plus. The majority had turnover from £6 to £10 million (twenty two), sixteen had between £51 to £100 million, fourteen from £26 to £50 million, followed by seven with over £100 million, five from £1 to £5 million, four with £11 to £25 million and two with under £1 million (see Table II.1 in Appendix II).

From the fourteen subjects' interviewed face-to-face three were Design Consultants, four Heads of Design, four Environmental Consultancy/Advisors and, three Professional Researchers involved in design and environmental research. The subjects were from UK based companies, the vast majority had number of employees from 1 to 49 while, the turnover of their companies varies with six having £6 to £10 million, four £26 to £50 million, two £1 to £5 million and, one under one million pounds (see Table II.3 in Appendix II).

Instruments

The instrument used in this investigation was a questionnaire consisting of nine open-ended items. The items included are as follows:

1) Do you have an environmental policy?

2) Do you market your products through 'green' labelling'? (If positive Go to: 2a.)
2 a) *If you use an environmental claim on your packaging product:* What type of logo/label you are using? and, How do you obtain/award the label?

3) Do you find the different environmental claims which appear on packaging misleading?

4) Do you believe that the different manufacturers claims for environmentally acceptable products are difficult to evaluate and compare? (For agreement Go to: 5., For disagreement skip to 6.)

5) *If you agree with the above statement,* could you please state reasons or/and cases in support of the argument that environmental claims on products and packaging are difficult to evaluate and compare.

6) The aim of the eco-labelling award schemes is to give a 'seal of approval' for products that are less harmful to the environment than other products in their class. Do you believe that the eco-labels award schemes bring liability in the market place for the product groups on which studies are undertaken?

7) *How do you see the role of EC Eco-labelling regulations (1992).* - Do you believe that the EC eco-labelling scheme is a useful marketing tool that helps manufacturers and retailers to promote products with minimum environmental impact among EU market?

8) Do you think that the EU Eco-label is appropriate for paper based packaging products? (If the answer is positive Go to: 9., If the answer is negative or uncertain Go to: 8a.)

8a) *If the answer is negative or uncertain* - Could you please suggest an alternative for environmental awarding of paper based packaging?

9) If you feel that you would like to add any comment in relation to the interview or about the research project it will be very welcome

4.3.1 Results

A content analysis was performed in order to analyse the data from the open-ended items (see Table II.4. in Appendix II). The majority of subjects claimed that their company have an environmental policy with forty three said always and twenty six most of the time, nine claimed that their companies hardly ever co-ordinate a policy and only three said that there is not at all any environmental policy activities within their companies. Thirty seven also claimed that they always market their products through 'green' labelling and thirty one most of time. Only two said hardly ever and two others said never. Subjects' stated that the most common environmental labelling they used on packaging indicated in the priority of the most common answered were as follows

- Recycling symbol from EU or Repak. *Indication of the percentage of recycled pulp, content of post consumer waste.*
- Recyclable symbol from the EU Directive on Packaging and Packaging Waste
- Manufacturers/ Retailers own labels.
- Biodegradable.
- Management forest Certification.
- Litter logo obtained from Britain Tidy Group
- Recovery/ Recoverable symbol from the EU Directive on Packaging and Packaging Waste
- Green Dot eco-label.
- Reusable EU.

Furthermore the data gathered revealed subjects' found environmental claims which appear in packaging misleading with forty three stated always and thirty six most of the time and, five did not express any preference. Moreover subjects' felt that the different manufacturers claims for environmental product acceptability are difficult to evaluate and compare precisely, sixty respondents said always, twenty two said often and, two did not express any preference.

In addition when subjects were asked to state reasons or/and cases in support of their agreement on the statement that environmental claims on products and packaging are

difficult to evaluate and compare. They stated the following reasons in a priority order based on the frequency of similar answers provided.

- Because there is not a common standardisation system to control the use of environmental claims on products and packaging. Likewise more legislation is required to control the use of environmental claims on products and packaging.
- There is also, a need for development of codes of practice that includes technological specifications, visibility, legibility issues and more information to be provided about the efficient use of labels.
- There are not clear LCA and assessment methodologies to evaluate the efficient use of environmental claims.
- The existence of so many different labelling systems resulting in confusion and cynicism.
- Elaborate in differentiation of products environmental impact, probably by using a standardised rating scale from one to ten had been recommended.
- Recommended that more research is required investing in technology and management.
- Irrelevant, misleading, confusing environmental claims made them difficult to evaluate and compare.

When subjects' asked if they believed that the eco-labels award schemes bring liability in the market place for the product groups on which studies are undertaken, their opinions were divided. Thirty one tend to believe in the above statement and thirty six tend to disbelieve while only four believed strongly and six disbelieved strongly. Similarly when subjects' asked if they believed that the EC eco-labelling scheme is a useful marketing tool that helps manufacturers and retailers to promote products with minimum environmental impact among the EU market their views were uncertain. Thirty six were not sure and twenty two felt probably. Four were totally supportive and eleven were completely against the use of EC eco-labelling scheme as a useful marketing tool to promote environmental qualities of products.

Further, forty three subjects' disapproved the use of the EU Eco-label to award environmental credentials for paper based packaging products, twenty were uncertain while only three were definitely approved and, seventeen did not express any opinion. Also, subjects' that were opposed to the use of the EU Eco-label for paper based packaging products were asked to suggest an alternative. Based on the respondents suggestions in the order of their preferences, alternatives for environmental awarding of paper based packaging were recommended as follows.

- Single environmental attribution label. A label awarded for each area of environmental consideration of products' life-cycle e.g. for the use of energy; recycling content; or

packaging biodegradability; The same description for awarding a label also called: Performance label. and, Packaging performance environmental values label.

- Eco-rating system. A standardised rating system on a scale of one to ten. - Explained as a scale of importance that differentiate products environmental performance.

- EMAS/ BS/ISO environmental certification. Environmental award for the product in relation to environmental management system and companys' environmental policy.

- Other options suggested include: One environmental label for the companys' performance and another for the product. or, A different label for the manufacturing process and another for the material used. or, A designer label for the construction of the packaging, easy assemble and disassemble, lightweight. or, Establishment of a packaging body (private or governmental) that awards and controls manufacturers environmental labels - standardised packaging products environmental performance.

Observations

The research interviews found the majority of subjects' to express interest in environmental issues related to packaging with most of the respondents companies to have environmental policy activities including marketing their products through green labelling. Although, it should be acknowledged that information on packaging products is often the first medium that consumers come across with regard to manufacturers in the retail arena. According to Marketing Intelligence's Product Scan, direct information about green packaging continues to proliferate in the marketplace and it immediately conveys to consumer how green the company is, although on a superficial level.

In relation to this, subjects' admitted that the use of environmental claims in packaging are misleading. Their comments included that consumers are exploited through misperception of environmental information on packaging and, that much environmental information is associated with spurious or inaccurate claims, e.g. as excessive, multiple or meaningless claims or claims which are not explained well.[1]

Subjects' confessed that the plethora of environmental claims used by manufacturers are difficult to evaluate and compare. A report recently published by the National Consumer Council (NCC) concludes that:

> 'Green' claims on many household products, such as *'recyclable'* and *'environmentally friendly'* are misleading or false, leaving consumers cynical and confused....and, as a result of the evidence we collected, we have come to the conclusion that regulation of on-product environmental claims needs to be substantially improved." (National Consumer Council, 1996: 4)

Similarly when respondents were asked to offer their views in support of the statement that environmental claims are difficult to evaluate and compare, the most common reasons

[1] See also 2.4 for misleading green marketing claims.

indicated that environmental claims were not mandatory legislative controlled neither, is there a code of practice or a standardised system to regulate them. For example, concerning criteria for packaging material, the Swedish Society for Nature Conservation does not have any criteria for packaging materials in the criteria for submitting the eco-label Bra Miljoval.[2] Furthermore, the EU Ecolabel (like other eco-labelling schemes see 2.5) gives an independent environmental certificate for the approved environmental performance of the product as a whole. And, even if it has the intention to develop eco-label for packaging material from the Competent body in Italy the studies have stopped because between other reasons, it was then, difficult to separate the packaging from the product and as a result could be misleading to award a label for the packaging and not the content at the same time.[3]

Although respondents opinions are divided on the usefulness of the eco-labelling schemes in terms of bringing liability and promoting products in the market that carry it, there is an obvious tendency of disagreement in terms of the use of the EU eco-labelling for paper based packaging. Their preference was towards a single attribution label, an eco-rating system and EMAS and BS or ISO environmental certification. In support of these preferences Doug Martin environment advisor at Arjo Wiggins Fine Papers, says that:

> *"The industry could work harder at communicating its message and clearing the confusion surrounding the various types of environment friendliness."* He concludes by saying that while a Europe wide label is some way off, he recognises that some sort of eco-rating system would be welcome, he says that: ***"Standardisation would be in everyone's best interest."***

Martin Jaques of Jaques Russell paper company believes that: ***"an eco rating scale would be a gift from the heaven for most designers."*** Jaques' (1996) says that on the problematic situation facing packaging businesses regarding the accreditation of their environmental performance is: *"there is so much technical data to digest and so much disagreement that you'd need a PhD to make sense of it all."* And,

> *"a standardised rating on a scale of one to ten would make the choice a straightforward decision."*

Daniel Rhodes of Rhodes Design, preferred the choice of a numbered scale. He added that

"Manufacturers would do themselves a huge favour if they produced clear information pack - I had to collect together some information for one client, but it was impenetrable, unbelievably technical."

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[2] Personal communication with Helena Andersson. Project Co-ordinator. Bra Miljoval, April 1996.

[3] Personal communication with EU Ecolabelling Board, March 1996.

4.4 Explanatory Stage *Phase B.*: Evaluating methodology for environmental auditing with regards to paper packaging products

Based on the findings from the previous stage of interviews, the second stage of research interviews aim to:

1st Evaluate methodologies for environmental auditing with regards to paper packaging products.

2nd Evaluate hypotheses about methodologies for environmental labelling with regards to paper packaging products generated from the first stage interviews.

3rd Generate recommendations about specifications for the *model* of environmental analysis to be explored at the investigation stage.

Formulation

The *interview schedule* followed the same format as the first stage interviews. It divided again into three sections: 1) the introduction where the aims of the research project and the interview are explained to the participant. 2) the personal details section where the respondent is asked to supply information about his/her position and the size of the corporation for the purpose of the analysis. 3) the questionnaire - interview checklist - that includes nine open-ended items. The *interview schedule* is assembled in a semi-structured format that means apart from the initial checklist, free discussion took place followed by probes to allow the respondents to express themselves at some length but without misguiding the purpose of the interview.

The sample was similarly selected from *The Institute of Packaging Directory and Review 95/96, Design Business Association 'Directory of members 1995/96'* and, *The Environmental Industries Commission Guide to the UK Environmental Industry 1996.* The sampling method can be classified as *stratified* by dividing the target population into homogenous groups based on their business activities such as: a) Consultants Packaging Design, b) Environmental Consultants Packaging, c) Packaging Retailer *Contract Manufacturing* d) Case/Cartons/Pulp Converters, e) Paper/board suppliers and, f) Paper & packing Manufacturer.

Participants

One hundred thirty one subjects' took part in this investigation. From those one-hundred seventeen were interviewed by phone out of the total of two-hundred and fifty contacted to be interviewed and, fourteen face-to-face. The professions of those interviewed by phone, were sixty-one Packaging Designers /Managers, fifteen Packaging Engineers/ Technologists,

nine in the position of Packaging Development Manager/ Director, eight Packaging Quality/ Assurance/ Control or Operation Managers, eight Packaging Marketing or Commercial Manager and, ten Packaging Environmental Affairs Director/Advisor.

The sample was from UK based companies, with thirty three having 100 to 249 number of employees, the same number as well had between 50 to 90 employees. Twenty three between 1 to 49 followed by nine with 250 to 499 and one with 1000 plus. The majority had turnover from £26 to £50 million (thirty two), twenty seven from £11 to £25 million, eighteen from £51 to £100 million, thirteen between £6 to £10 million, eleven with £1 to £5 million, seven over £100 million and two under a million (see Table II.1 in Appendix II).

From the fourteen subjects' that were interviewed face-to-face three were Design Consultancy, four Head of Design, four Environmental Consultancy/Advisors and, three Professional Researchers involved in design and environmental research. The subjects were from UK based companies, the majority (twelve) had number of employees from 1 to 49 while, the turnover of their companies varies with six having £6 to £10 million, four £26 to £50 million, two £1 to £5 million and, one under one million pounds. (see Table II.3 in Appendix II)

Instruments

The instrument used in this investigation was a questionnaire consisting of nine open-ended items, as follows:

1) Do you believe that UK packaging companies are aware of environmental issues affecting their production? (If positive reply Go to: 1a., for negative/unsure Go to 2.)
1 a) If the answer is positive, please indicate what are the major environmental concerns for todays' paper packaging businesses?

2) Do you believe that packaging companies identify the need to address the environmental friendliness of their products on a 'cradle-to-grave' basis?

3) Do you believe that the plethora of different environmental claims on packaging for products with minimum environmental impact are difficult to evaluate and compare?

4) Do you find appropriate for packaging products to be awarded with a single attribution label for each environmental merit for example one label for packagings' recycling content and another for the efficient use of energy during manufacturing on a scale from one minimum to ten maximum?

5) Do you find it appropriate for packaging products to be awarded a label that addresses the environmental impact of the product in all life-cycle stages (using LCA methodology) on a scale of importance that differentiate products environmental impact starts from zero equivalent to *'non-green'* products' for products that are not considered of any environmental impact areas during LCA stages to *'dark-green'* applying to products that considered every single aspect of their LCA stages?

6) Do you find it appropriate for packaging products to carry an environmental award (label) that applies on considerations about products' environmental impact in relation with and with effects about companys' environmental profile - companys environmental policy and activities?

7) Do you believe that when a packaging product carries an environmental award (label) for its environmental qualities in conjunction with companys' environmental activities, it should be as a result of environmental auditing methodology?

8) Do you believe that UK packaging companies incorporate an environmental audit programme review? (for positive answer Go to: 8a. , otherwise Go directly to: 9)

8a) *If the answer is positive* - Could you please give information about what the audit involves?

9) If you feel that you want to make any suggestion or offer any comment in relation to the current state of environmental auditing and LCA with regards to paper packaging products, please do so?

4.3.1 Results

A content analysis was performed in order to analyse the data from the open-ended items (see Table II.5. in Appendix II). The majority of the respondents (seventy-nine) felt that UK packaging companies are aware of environmental issues affecting their production while, thirty-six believed most of the time, four tend to disbelieve and in contradiction twelve disbelieved strongly. The responses on the item about the major environmental concerns for todays' paper packaging business include the following answers as indicated in a priority order of most often stated preference.

- ***Environmental legislation.*** e.g. EU Packaging and Packaging Waste Directive, Air water and ground pollution, Waste minimisation, and Suppliers legislation.
- ***Producer obligations and penalties.*** e.g. Duty of Care obligation, Litter and Waste transportation penalties.
- ***Codes of practice.*** e.g. EMAS./ BS 7750./ ISO 9000, 14001
- ***Suppliers environmental audit and Forestry certification.***
- ***Environmental Technology.*** e.g. ECF, TCF and totally closed mills./ Materials innovation. Lightweight. Biodegradability
- ***Green marketing.*** i.e. Consumer demands pressures.
- ***Environmental profit. Investment in clean technology***
- ***Ethical investment/ responsibilities.*** Investors/Shareholders pressures.

The opinions of subjects' varies considerably when they were asked if they believed that packaging companies identify the need to address the environmental friendliness of their products on a 'cradle-to-grave' basis. Most of the respondents (46) tend to disbelieve, followed by thirty-two that indicated never (disbelieved strongly), twenty-four believed

always. Seventeen tend to believe that most of the time their companies conducted a 'cradle-to-grave' analysis of the environmental performance on their products' and, twelve did not indicate any preference. However, when subjects asked if they believed that the plethora of different environmental claims on packaging for products with minimum environmental impact are difficult to evaluate and compare, the majority (92) felt always, twenty-nine felt most of the time only six felt hardly ever and four did not comment.

Based on the findings from the previous stage of the research interviewees three alternatives hypotheses were formulated for environmental awarding of packaging. Most popular preference was for packaging products to carry an environmental award (label) that applies to considerations about products' environmental impact in relation with and with effects to a companys' environmental profile - *companys' environmental policy and activities* - with 48 agreed strongly, 57 tend to agreed and, 19 tend to disagreed.

Second given preference was for packaging products to be awarded a label that address the environmental impact of the product in all life-cycle stages (using LCA methodology) on a scale of importance that differentiate products environmental impact starts from zero equivalent to *'non-green'* products' for products that are not considered to have any environmental impact areas during LCA stages to *'dark-green'* apply on products that considered every single aspects of their LCA stages - 37 agreed strongly, 45 tend to agreed, 21 tend to disagreed and, 17 disagreed strongly as they found this method very complicated. Respondents third preference was the award of a single attribution label for each environmental merit for packaging products, for example one label for packagings' recycling content and another for the efficient use of energy during manufacturing on a scale from one minimum to ten maximum - the numbers are 20 agreed strongly, 27 tend to agreed, 45 tend to disagree and, 33 disagreed strongly.

In addition, other alternatives suggested on environmental awarding of paper based packaging included EMAS/ ISO certification, Environmental cards, Forest certification and stated that the use of LCA and impact assignment should be considered for environmental awarding of paper based packaging.

There was a tendency to agreement on the statement that when a packaging product carries an environmental award (label) for its environmental qualities in conjunction with a companys' environmental activities, it should be as a result of environmental auditing methodology, with 34 believed strongly, 72 tend to believe; in opposition 13 tend to disbelieve and, 12 did not expressed any preference.

Furthermore, most of subjects' believed that UK packaging companies did not incorporate an environmental audit programme review, with 32 disbelieved strongly, 46 tend to disbelieve and in opposition 24 felt absolutely positive and 17 tend to believe, 12 did not state any preference. Respondents with a positive answer were asked to give information about what the audit might involved. Their answers were as follows stated in a sequence of the most common auditing activity conducted.

- Compliance with legislation
- Control Environmental Impact
- Specific management aspect related with corporate policy *e.g. BS 7750*
- Particular area of the organisation operation *e.g. energy and resources conservation*
- Waste management audits
- Suppliers audit
- Quality control audits
- Verifying operation systems
- Cost saving audits

Observations

Respondents claimed that UK packaging companies were concerned about environmental issues related with their production moreover, conventionally in relation with the EU Directive on Packaging and Packaging Waste agreed in December 1994 and, approved through regulations by Parliament in March 1997 that set specific targets for the recovery and recycling of used packaging. Particular areas of concern are: suppliers legislation and comformability with regulations covering air, water and ground pollution, packaging end-use, raw materials conservation, forestry certification. Also, public concerns on demands of environmental orientated products, environmental profit by investing in clean technology practices and inventors interests on enhancing and maintaining an environmental and ethical profile for the company.

Furthermore, there is a growing interest in developing of environmental management systems (EMSs). A Senior Packaging Technologist commented in an interview that EMSs are a 'necessary' part of business activities towards good management and good housekeeping and are giving reputations and credibility in business environmental performance. Barrett (1995) gives an example that one leading tissue products manufacturer in the UK has been told by a major retailer client that it will be expected to have a certified environmental management system.[4] Both Confederation of European

[4] Barrett, J. (1995), European Policy -Makers Soften Command and Control Approach, in 'Pulp and Paper International', June issue, pp. 74-77

Paper Industries (CEPI) and the European Tissue Symposium (ETS) propose this approach as an alternative to eco-labelling.

According to CEPI (1995), the advantage of EMAS is that, unlike eco-labelling, it takes account of different national starting points in the regulatory field and focuses on environmental improvement.[5] However, the International Institute for Environment and Development (IIED, 1996) find that because of this very aspect of EMAS is likely to make it unacceptable as an alternative to eco-labelling, as it potentially allows all producers to be certified even if they vary considerably in terms of performance.[6]

However, it should be considered that Environmental Management Systems assess the environmental performance of a company rather than the product. Typically, those companies certified or verified are allowed to use a logo on corporate publicity material but not on their products and packaging. But, even if EMS do not certify/verify products and packaging, product and packaging remain an interconnected component of business activities.

In addition, even if it has been established that to award packaging under an eco-labelling scheme is not the most desirable option, there is an urgent need for packaging to have an assessment methodology for its environmental impact. Comparisons on respondents opinions from the first survey, the first stage of interviews with the second stage of the findings reveals that there is no corresponding difference in their beliefs about the existing use of various environmental claims on packaging. The majority of the subjects' (92) on the second stage of research interviews also found environmental claims on packaging to be difficult to evaluate and compare with 32 who disbelieved strongly and, 46 who tended to disbelieved (stated in response to the enquiry if their companies identify the need to address the environmental performance of their products on a cradle-to-grave basis). But, cradle-to-grave LCAs and auditing methodologies are the basis to evaluate the environmental performance of a product and packaging in order to award an environmental certificate.

Alternative approaches to eco-labels are evaluated in the section below.

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[5] CEPI (1995), Miscellaneous Press Releases on Eco-Labelling, Confederation of European Paper Industries, Brussels, Belgium

[6] IIED (1996) 'Towards a Sustainable Paper Cycle', International Institute for Environment and Development

4.5 Primary considerations on environmental awards for paper and board packaging

At present, there is no environmental label to certify the environmental qualities of paper packaging products, for packaging retailers, constructors and manufacturing companies. Studies conducted about packaging material *(defined as product category by the EU ecolabelling)* by the Competent Body in Italy stopped because of the complexities of this product category (UK Ecolabelling Board, personal communication, March 1996). Most of the ecolabelling schemes which define the environmental impact of the packaging - always in relation to the product - mention only one environmental impact area of packaging. For example the EU Ecolabelling scheme when defining criteria for single-ended and double-ended light bulb - recommend cardboard packaging that must contain a minimum of 65% recycled material (by weight)[7]. Single-attribute-certification environmental labels awarding as well the recycling content on packaging products. And, the only environmental logos/symbols for packaging that are in existence are about recovery and recycling of packaging waste[8].

Another issue to be addressed is that during the second stage of interviews it was revealed that the UK and European packaging industry was not always interested in the use of eco-labelling. In relation to this point, the British Waste Paper Association commented that: *'the European packaging industry is not interested in Eco-labelling or life cycle analysis'*[9]. The same belief is shared by EC, Council Regulation on the Community Eco-label award scheme, where the overall position of the European industry towards the development of the Community scheme has described in general as taking a very reserved vis-à-vis position. The EC found only the European Association of the Textile Industry and the European Confederation of Paint Manufacturers to have fully supported the implementation of the Community eco-label in their sector. In addition, EC comments that: *'many associations which are bound to represent the interests of the whole or at least the majority of their members, do not favour this approach'*[10].

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[7] 'Ecolabel Criteria', UK Ecolabelling Board Factsheet, No. LB/1, May 1996

[8] For symbols for reusable; recoverable packaging, identification system for plastics; and percentage of recycled materials see: Packaging and Packaging Waste Directive, Official Journal of the European Communities, No C 285/1, ANNEX I, Marking

[9] Personal Communication with the Mr. Jones, G, National Secretary, British Waste Paper Association, 2. August. 1995

[10] The approach of the EU ecolabel is related to its selective nature, as criteria established in such a way that only a number of products can qualify for the label. This approach introduces competition between manufacturers on environmental ground and is the key difficulty of European industrial associations. - See EC, Council Regulation on the Community Eco-label award scheme, 2/12/96, p. 9

Summarising the comments offered during the second stage of interviews, corporations may consider the following in relation to environmental awarding of packaging.

⇒ Implementation of LCA methodologies for the design and production of a particular product related to (and effecting) a company's environmental policy with vision and a strategic management plan in place.

⇒ Feasibility studies that address a pragmatic approach to the comparison of environmental investment and cost benefit analysis.

⇒ Comparative studies with products in the same product category[11], to reveal potential areas of improvement and to address the environmental impact of the product in all life-cycle stages.

⇒ Continuously improving with minimum award (label) period of up to two years - especially for products where technology changes rapidly.

⇒ Avoiding the confusion or misperception when a product carries an environmental label (outside its country of origin) where the label is not validated (e.g. Green Dot used in products in the British market without any explanation to consumers).

⇒ Competitive advantage to corporations coming from the use of an international label and system commonly accepted and recognised.

⇒ Investing in research and development for future product innovation. Such products' may appear to carry exceptional or additional environmental benefits, outside the scope of ecolabelling.

In addition to the above list, environmental labelling programmes should consider not just the setting of standards on existing products but standardising provision and guidelines for environmentally responsible products in the future. Corporations should employ technology, design creativity, accounting and management science to create such products. Design management abilities are essential to co-ordinated such progress (see chapter 2.10 for the role of design management in establishing 'green' concepts on packaging products).

To assess the environmental performance of paper and board packaging - based on the findings from the previous stage of interviews - three options are evaluated as follows:

1. **Performance Eco-Values (PEV)** - ***Single environmental attribution*** Performance Eco-values credentials are used in awarding some environmental qualities of the product. Each eco-values represents different environmental attributes of the product on a scale start from one - minimum to ten - maximum (e.g. a product could award 5 for its recycling context and 7 for the efficient use of energy during manufacture). This system

[11] 'product group' and 'product category' is the same definition used by ecolabelling schemes to describe the particular products that are examined under the scheme, for example: detergents; washing machine; light bulbs etc.

has similarities with the environmental cards, as it is giving a full description for each environmental attribute of the product.

2. **Eco-Rating Scale (Eco-S) - *Assess the environmental impact of the product in all life-cycle stages*** The Eco-Rating scale addresses the environmental impact of the product in all stages of the products life-cycle. Using LCA methodology products under this system are rated as 'Dark Greens' for superior environmental performance equivalent to products that considered every single aspect of their LCA; 'Green' for acceptable environmental performance applying to products that are considered less aspect of their LCA stages followed by, 'Light Greens' equivalent to products for considering less environmental requirements during their life-cycle and, 'Non - green' for not awarding any environmental merits.

3. **Environmental award and Eco-points - *Assessing companys' environmental profile*** This study views the packaging product (the formulation and the design of the product) as a result of the companys' environmental policy. The intention of the study was to examine the product as a part of the holistic management and marketing; examining aspects related to industrial ecology and employing life-cycle-analysis to investigate the environmental impact of paper packaging products' from the selection of raw materials; to manufacturing; use; and final disposal. The 'Environmental award' is used as a more comprehensive form of environmental analysis in assessing the environmental performance of the companys' with effect to the final product.

The 'Environmental award' most popular preference is used in assessing the producer (manufacturer/ retailer) for their environmental performance (policy and initiatives) that are in place, while the use of eco-values awarded to a products' single contribution on the environment, and the Eco-S award products for their whole environmental performance. Respondents preferences are towards the use of the Environmental award' and a rating scale like the Eco-S award. Those two options are explored and evaluated in more details on the phase A. of the investigation stage in the next chapter.

The relationship of the 'Environmental award' with the Eco-values and the Eco-S is illustrated in the Figure 4.4 follows.

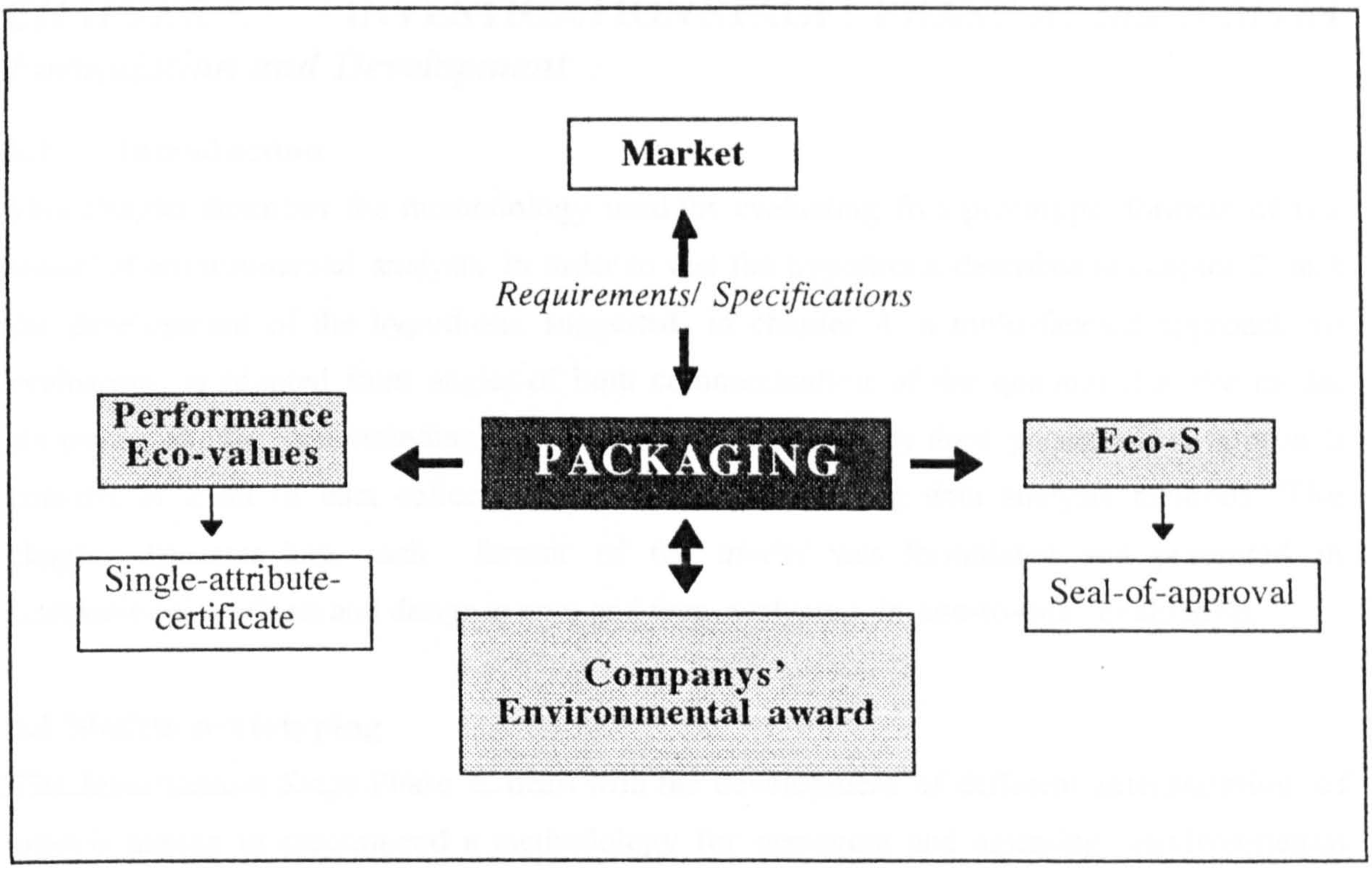

Figure 4.4 *Methodology for environmental awarding paper packaging products*

4.6 Summary

The current situation in the use of environmental claims on products and packaging has been examined and furthermore, methodology for environmental labelling and auditing for paper based packaging has been assessed.

Following this, the evaluation of the findings from the first survey, research interviews and, the observations made provide specifications and directions for formatting different *models* of environmental analysis to examine and assess the environmental performance of packaging, presented at the next chapter.

The main conclusion drawn from the explanatory stage of the study is that the *model* of environmental analysis should include three factors: environmental management systems (EMSs) principles, theory and methodology; LCA and auditing assessment methodologies and, the differentiation of products and packaging environmental performance.

CHAPTER 5. INVESTIGATION STAGE: PHASE A. *Initial Model Formulation and Development*

5.1 Introduction

This chapter describes the methodology used for evaluating five prototype formats of the *model* of environmental analysis. In order to test the hypothesis described in chapter 2. and the development of the hypothesis suggested in chapter 4. a multi-faceted approach to evaluation is adopted from angles of both communication of the qualities that the model are posing and the understanding and effectiveness of its use by third parties. This approach consists of a set of data collection techniques and differing data analysis methods. The chapter discusses how each format of the *model* was formulated and presented in international business and design events and then evaluated in one-to-one evaluation.

5.2 Models prototyping

The *Investigation Stage* Phase A. deals with the development of different interpretation of *models* aiming to recommend a methodology for managing and assessing environmental issues related with companys' policy and products' requirements such as packaging. Prior to the interviews where each format of the *model* was tested with specific participants, the *model(s)* of environmental analysis were presented in international business and design events. The progress of the research study was also presented.

Five prototype formats of the model of environmental analysis were developed and presented in five refereed papers reporting the research in progress and explaining how each *model* operates. Following this, based on the five different interpretations of the model, five different interview sessions took place for evaluating each prototype format of the model. Before examining how the models were evaluated (see 5.3.1), presented and analysed (see 5.3.2) the development process has to be explained in chronological order. These process was as follows:

The first prototype format of the *model* of environmental analysis was presented in March 1996 at the International Conference '*Whose Values?*'- *Ethics in the International Business Environment.* The participants of this event were from businesses and academia also, researchers with background in business and management (not in design). This audience was appropriate to present the paper *"Environmental Business Strategy: A new Model for Development?"* that talks about the use of environmental information on products and packaging and emphasises the role and environmental responsibilities for businesses in the use of such information. The first *model* for environmental analysis figure 5.1 (see 5.3.2) observes the development of an ethical code of practice related to environmental issues

between the producer, verifier and consumer and, its' effects on product design and packaging. At the same event an evaluation was presented - in the format of a scale of importance - between ethical investment in the use of environmental information and their appearance (labelling) on products.

The second prototype format of the *model* that deals with eco-design and design management found the most appropriate audience to be the Industrial Designers Society of America (IDSA) 'Alternatives Realities', Worldesign '96 Conference. The model illustrates the relationship of the 'quality of management' that considers 'environmental issues'; 'environmental standards'; 'eco-design' characteristics; 'sustainable development' indicators, and its' effect on the 'quality of life'. The main emphasis (see figure 5.2 in section 5.3.2) to come is that design needs the development of 'environmental standards' to progress and improve eco-design products and packaging, while avoiding pitfalls in terms of, for example, choosing materials or evaluating related ecodesign concepts.

The evaluation of environmental information on products and packaging in a scale of importance, was an idea that gathered momentum and support during the research interviews at the explanatory stage (see 4.5) an attempt was made in the IDSA conference to rate the outcomes of ecological assessment in this format. Eco-S stands for Eco-Scale/Eco-System (see figure 5.3 in 5.3.2) shows the concept of an eco-rating scale being developed to assist designers and design managers to cope with the complexity of eco-design, regarding the different levels of business environmental commitments.

At the 'Business Strategy and the Environment Conference' (1996) a third prototype format of the *model* was presented that spoke about auditing methodology and considerations regarding the environmental performance of business with effects on their products and services, as the audience was from business background (working on a business sector or teaching/researching about issues related with business and environmental performance). The auditing *model* described in Figure 5.4 (5.3.2) recommends the stages that the environmental auditing methodology should follow towards the development of an environmental management strategy. Also a comprehensive format of auditing considerations was presented. The *model* is shown in figure 5.5 (section 5.3.2) and gives an overview of the progress that an environmental action policy should consider to establish a management plan.

At the *'The 8th International Forum on Design Management Research and Education'* (1996) conference the first format of the Environmental Management Control System (EMCS) model presented and represented the fourth prototype format of models of environmental analysis. The EMCS *model* (see figure 5.6 in section 5.3.2) works to produce environmental sensitivity on products and services by introducing a plan of action for managers and design managers. The EMCS *model* emphasises the need for the adoption of environmental standards.

At *'The European Academy of Design'* (1997) conference an overview of the research study was presented along with the fifth prototype format of the model called MEPA (Measuring Environmental Products Acceptability) *model* that is more directly related to auditing design activities. The MEPA *model* illustrated in figure 5.7 (presented in 5.3.2) is a comprehensive format of the model of environmental analysis and auditing design activities which conceptualised the applicability and the requirements of an ecologically orientated design.

The models are formulated to be adopted for a periodic and systematic approach to environmental auditing review and procedures in support of an environmental management system and differentiation of products and packaging environmental qualities.

5.2.1 Procedures

The methodology used to formulate and test the five different prototype formats of the *model* of environmental analysis followed the hard systems approach as described in chapter 3.4.3. This approach consists of nine stages according to Waring (1989: 56-61) the first four stages covered in chapters 2 and 4, were: 1st *Groundwork*, 2nd *Awareness*, 3rd Goals and *objectives* and 4th *Measures*. The 5th *Models* - this stage is about testing possible options (different prototype formats of the model) against measures of performance, followed by 6th *Evaluation* - which is about assessing the likely outcomes of each option under a range of possible conditions; testing credibility with client set. Those two stages developed in the *investigation stage* phase A. of the research are presented in this chapter. Moreover the 7th *Making a choice* stage of hard system approach that deals with the choice of best solution (model) from the tested options (prototype formats of different models) and 8th *Implementation* stage aimed to be developed and explored in detail in the *testing and evaluation stage* of the research (presented in chapter 7).

The first prototype format of the *model* constructed was based on the observations made in the previous chapter (see 4.5), the interrelation of the data and links hypothesised to exist were based on observations made in chapter 2. Furthermore, the study includes within each prototype format of the *model* the three component parts of a system such as a) inputs - which provide the system with what it needs to be able to operate b) processes - that transforms an input into an output and, c) outputs - which are the results of the operation of a process.[1] The thinking of prototyping each of the five different process *model* based on the definition provided by ICSA (1993: 202).

> Prototyping, potentially, is not so much a design technique but a whole new approach to the design and construction of systems. A prototype is a *model* of all or part of a system, built to show users early in the design process how it will appear. ....The user could make suggested amendments, which would be incorporated into the next model.

The five models were prototyped on the basis to be different experimental prototypes. The scope was to construct different prototype formats of environmental analysis models that differ in the way, the variety and the amount of the information presented in each model. However the same aim applied for each prototype format of the models and that was to structure a format that implemented environmental management systems practices compatible with the packaging design process. Furthermore what is aimed to be achieved from the construction and testing of different experimental prototypes was to select the most advantageous model in terms of performance, applicability in use and user understanding to be explored in an evolutionary prototyping approach (see 7.2) that constructed the final recommended model.

The formulation of each prototype format of the model was viewed from diverse angles. The first format was closely related to business environmental practices and ethics about the use of environmental information on packaging products. The second format of model prototype emphasised the management approach in relation to sustainable development principles, environmental standards and with effects about eco-design development. The third format examined the role of environmental auditing as a part of management strategy related to corporate and environmental policy. The fourth format presented the stages of environmental policy in relation to strategic management and auditing. Finally the fifth format was an interpretation of ecological design considerations.

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[1]Institute of Chartered Secretaries and Administrators. (ICSA, 1993) Study text. *Pre-Professional Managing Information System*, BPP Publishing Limited, London, p. 85

Finally even if each prototype format synthesised under a different *spectrum* - *the intention of the researcher was to interpret the information material presented in each model different to each other* - the observations made during the testing of each prototype format considered in developing the next format of the model prototype and included in the formulation of the final solution.

The conceptual thinking in modelling the different prototype formats of the models is defined as follows.

> Conceptual modelling aims to model the desired system precisely. The model is built on an abstract level, which means that no details concerning data representation or plans for systems implementation are included. The aim is to create a *natural* model, which means that the model corresponds on a one-to-one basis with user concepts of parts of the real world definition of their requirements (ICSA, 1993: 204).

The prototype format that followed for conceptual modelling used three elements: a) the *structure* component consisting of entities, attributes and relationships, b) the *rules* component consisting of restrictions on the elements of the structured component and c) the *process* component consisting of all the processes which operate on elements of the structure component.[2]

Having examined the thinking in constructing the different prototype formats of the models the following options have examined. Initially, the most desirable option for the study to test the different prototype formats of the *model* was to arrange a day and place (provided at De Montfort University facilities) for presentation, to select participants, giving them plenty of notice and invite them along to attend the presentation and give their feedback on the models. This option has been rejected mainly for reasons such as: the participants have to take a day off from their work to take part in the research exercise and evaluation. Also, people contacted for this purpose expressed the problem of the time available and some suggested it be sent to them for evaluation. In addition, these presentations have to be repeated for all the different formats of the *model*. It should be noted however, that at that stage the researcher did not know how many formats the *model* will take and whether it will be practical or feasible to organise the many presentations required.

The second option that has been found more applicable was to present the *model* and the process of the research in events that are recognised for their reputation in the design and

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[2] Ibid.

business environment and, then test each different format of the model in one-to-one evaluation.

The acceptance for presentation of the models in major referred conferences also provided credibility for the research study. In addition there were benefits such as meeting different audience in different events thus providing a wide range of people with whom to discuss the research and the different prototype formats of the model. The researcher also acquired gained experience by attending presentations of other research projects in different stages, including completed research outcomes or research in progress. By publicising the progress of the ongoing research the work gained credentials and the paper that presented the model was widely disseminated for evaluation.

Instruments used in presentations

Each presentation was about twenty minutes to half an hour maximum, allowing ten to fifteen minutes approximately for discussion and questions depending on the schedule of the event. Overheads, slides and power point presentation material was used to illustrate the points. The time of the presentation was divided between to three to five minutes maximum for introduction of the subject of the paper and the aim of the research project, depending on the audience familiarity with the subject area. Next findings of the research in relation to the model creation was presented (five to ten minutes). Then the models of environmental analysis were presented and explanations given, allowing at the end two minutes approximately for conclusion and closing. The feedback of these presentations was useful and encouraging for the further development of the *model* (in different stages). The audiences were extremely positive and expressed enormous interested in the presented work.

5.2.2 Observations

The presentation of the research in conferences was considered as an opportunity to meet people and discuss ideas in the research area. This is in addition to the feedback obtained in one-to-one evaluation organised and achieved by following a structured research interview methodology with selected key people (see 5.3), attendance at suitable national and international conferences afforded on additional opportunity to receive less structured but nevertheless valuable commentary of the work in progress.

The intention during informal discussion with the participants of the events after the presentation was to gain comments in the research work, in particular to provide indications about strengths and weakness on the different formats of the models. Overall observations from the comments from informal discussions were as follow.

- the models provides a useful ground for conceptualise design requirements with company's environmental performance targets,
- overall the different prototype formats of the model were found to be in a complex form with a lot of information on display and lots of directions to be followed,
- suggestions for improvements include simplicity on the formulation of the model and, that deals with reducing the stages to be followed and the use of more direct, simplified and, existing terminology if possible,
- in general it was supported the idea of assessing the environmental performance of a company in relation to the product by the use of an eco rating scale (Eco/S),
- from the five formats of the model the EMCS model appeared to perceived more positively and, the one with more potentials to be explored. It was also, suggested that attention required to modified the model in more direct and communicative form.

5.3 Interviews and Testing

The presented *models* were evaluated after each event by interviews with individuals from packaging constructor and retailer companies, paper and packaging manufacturers and design and environmental consultancies. In the investigation stage phase A. five different formats of the model of environmental analysis were produced as described above (section 5.2) and evaluated in five groups of interviews *(see appendix III. Model prototyping Interviews Checklist).* However, it should be noted that while the observations from each model testing considered the next format of the model, the interview plan and the evaluation questionnaire used remain the same for each different format of the model. In that way the analysis follows the same rigid formula avoiding mistakes to be made on duplication of data and allows comparisons to be made between the different formats of the model.

The intentions of the *model* summarised as to establish a credible and straightforward way to monitor, control and assess the environmental performance of the company in relation to and with effects upon the final product and packaging. Furthermore, such way (instructed as *model*) aimed to be able to demonstrate the differentiation of packaging products' qualities with regards to differ environmental impact and performance. Outlined the aims of the *models* evaluation were as following:

1st ***Understanding.*** To clarify any misconception on the fundamentals intentions of the model and estimate the level of understanding and communication of the qualities of the model.

2nd ***Performance.*** To check the degree of effectiveness of the *model* based on the practical background of the potential respondents. Test possible options against measures of performance.

3rd ***Improvements.*** To accumulate recommendations for improvements to be considered for inclusion in the next format of the model.

5.3.1 Methodology used in interviews and testing

Each format of the model prototype after presented in international business and/or design events assessed in one-to-one evaluation. The potential interviewee was contacted by phone with a request to participate in the research progress. The aims of the study and the interview were explained. When the contact was successful and the respondent offered a day to be interviewed arrangements were made for the interview according to the *interview schedule*. The *interview schedule* followed a pre-arranged structured format described below, the selection of the participants and the instrument used are also discussed in the followings sub-sections.

Interview Method

The structured format of the *interview schedule* aimed to provide consistency to the data gathering. That enabled the researcher to analyse the collected information and anticipate any recommendations for improvements made and, the changes required for developing the qualities of the model. The duration of the interview based on the evaluation questionnaire used was about twenty minutes apart from the free discussion that took place in response to the last item of the questionnaire. The interviews followed a pre-arranged plan supported by the use of a multiple-choice questionnaire informal discussion took place at the end of the interview questionnaire. In that way, respondents were given the opportunity to present their views associated with the research project and, to add any significant comment in relation to the model that might be missed out or not described adequately from the interview questionnaire. The length and the depth of the conversation varies depending on the availability of the participant to explore further the topic that was under investigation.

Interview Participants

The participants were selected from *The Institute of Packaging Directory and Review 95/96, Design Business Association Directory of members 1995/96,* the Chamber of Commerce Database and some participants from the explanatory stage of the research interviews. The sample method based on *dimensional sampling* that is a further refinement of quota sampling - thus described as the non-probability equivalent to stratified sampling.

Dimensional sampling defined by Cohen et.al., (1994:132)[3] as identifying various factors of interest in a population and obtaining at least one respondent of every combination of those factors. Thus, in the study the target population were those involved in creation of packaging and distinction was made between the attitudes to the *model* of those who manufactured the packaging, those in papermaking (suppliers), those that were giving environmental advice for packaging and, those specialised in packaging design and consultancy. The sampling plan aimed to obtain minimum two responses from each predetermined group of professionals: a) packaging constructor/ manufacturer b) paper and board supplier c) environmental advisors and, d) design consultancies.

Interview Instruments

Respondents that agreed to be interviewed received copies of the *model(s)* by post or by fax, minimum a week in advance prior to the arranged day of the interview. A covering letter was posted to them describing the research project, explaining the aim of the interview, reminding the day and time that have been arranged for interview and acknowledged participants contribution on the progress of the research and the further development of the model. In addition the *evaluation questionnaire* included aiming to give subjects' plenty of time to think in advance about their replies and to prompt the discussion during the interview on the desirable track.

The following *evaluation questionnaire* consists of nine items, from those six supported by a second item that used dependants as the form of respondent reply, one has a group of items as a choice for the respondent, plus one item asking for more information. The item that asked for additional information were about the research project and the overall performance of the model, on some occasions complimentary models and tables were used in support to the evaluation of the *model* of environmental analysis the free discussion directed in assessing those features incorporated in the main *model.* Moreover, in relation to the final item of the questionnaire when subjects' offered comments about the study and the *model* such data is reported in the appendices and the most important evaluation included in the findings in section 5.3.2. and 5.4. The items presented on the *evaluation questionnaire* used for testing and the five different formats of the *model(s)* were as follows.

1) Do you find the model to be effective in use by packaging constructor companies and paper manufacturers?

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[3] Quoted by Bennett. N., et.al. (1994) Improving Educational Management through Research and Consultancy, The Open University, UK

1a) If you have any reason to disapprove the effectiveness of the model, please feel free to state such reasons.

2) Do you understand the directions and the links indicated by arrows from one stage to another? *If negative or uncertain answer.* 2a) Please state if something is missing or not described adequately.

3) Are you familiar with the terminology used?

4) Does the terminology describe adequately well the stages indicated? 4a) *If you feel that the terminology is not appropriate.* - Please feel free to make any suggestions.

5) Is the model self explanatory from one stage to another?
If negative answer. 5a) Do you feel that more instruction is needed?

6) Do you think there is enough information and direction provided? *If negative answer.* 6a) Do you think that there is not enough of information/direction included? Please feel free to make any recommendations.

7) Do you find the model to have a practical application for packaging businesses? *Provided that the answer is negative or uncertain* - 7a) Could you please state the reasons in support of the statement that the model has not a practical application for packaging businesses;

8) Who do you believe could use the model?
a) Environmental manager; b) Environmental Consultancy; c) Environmental auditor (internal or external); d) Head of Design/ Design Manager; e) Design Consultancy; f) Other. (Please specify)

9) Do you have to add any comment in relation to the model(s) and the research project.

At the day of the interview the response questionnaire was repeated to the subject - and notes have been kept. On some occasions the interviewee sent back the questionnaire with comments and complimentary information i.e. company's brochures, leaflets and other publications.

5.3.2 Findings from interviews and testing

The analysis of the findings from the open-ended items of the *evaluation questionnaire* followed the standard format of content analysis although, cross-sectional analysis[4] is used to identify regularities by making comparisons of variations across the sample.

The same *evaluation questionnaire* was used for each of the five formats of the model and can be found in Appendix III.

[4] For *cross-sectional* analysis see Easterby-Smith. M., et al. (1994) *The Philosophy of Research Design'*, as published in chapter 5., p. 77 in the book Improving Educational Management through Research and Consultancy, by the Open University, UK

Findings from the First format of model testing

For the evaluation of the first format of the model prototype nine subjects took part. The business activity of the respondents companies were three packaging constructor/ manufacturers, two paper and board suppliers, two environmental consultancies and two more design consultancies. The position of the subjects were three Head of Production or Managers, two Packaging Controllers or Specifiers, two Packaging Designers and two Environmental Advisors.

The model pictured in Figure 5.1. was presented to the subjects for evaluation. The model indicates the relationships on environmental grounds between the *'Producer'*- responsible for implementing an acceptable environmental solution, the *'Purchaser'*- responsible for conceptualising the greening of business, in terms of demands for 'green' products and, the *'Verifier'*- responsible for controlling the 'greening' of business. Some indications are given of what the Producer should do, in relation to environmental policy - in terms of a proactive policy and forward planning and about the organisational structure. The model emphasises that the environmental achievements should be reported both to Verifier for accreditation and general public thus enhancing the producer's environmentally responsible image.

A content analysis (see Table III.1. in Appendix III) of the data collected from the one-to-one evaluation showed that subjects felt that the relationship between the producer, purchaser and verifier is very transparent and that the impact of environmental issues is described adequately well. Subjects also felt that the directions for the producer are precise. and that all the requirements for the consumer (purchaser) are included.

With regard to the practical application of the model, subjects found the hierarchy of the producer activities in a good order. However, they indicated that more information is required about eco-design characteristics and requirements. In addition subjects felt that they needed more explanations and directions about legislative requirements affecting their production; likewise subjects needed additional information about methodology in conducting an environmental impact assessment. Subjects were dissatisfied with the use of the terminology. They reported that they required additional thinking to understand some unfamiliar terms, examples are the wordings 'ethical control system', and 'ethical investment initiatives'.

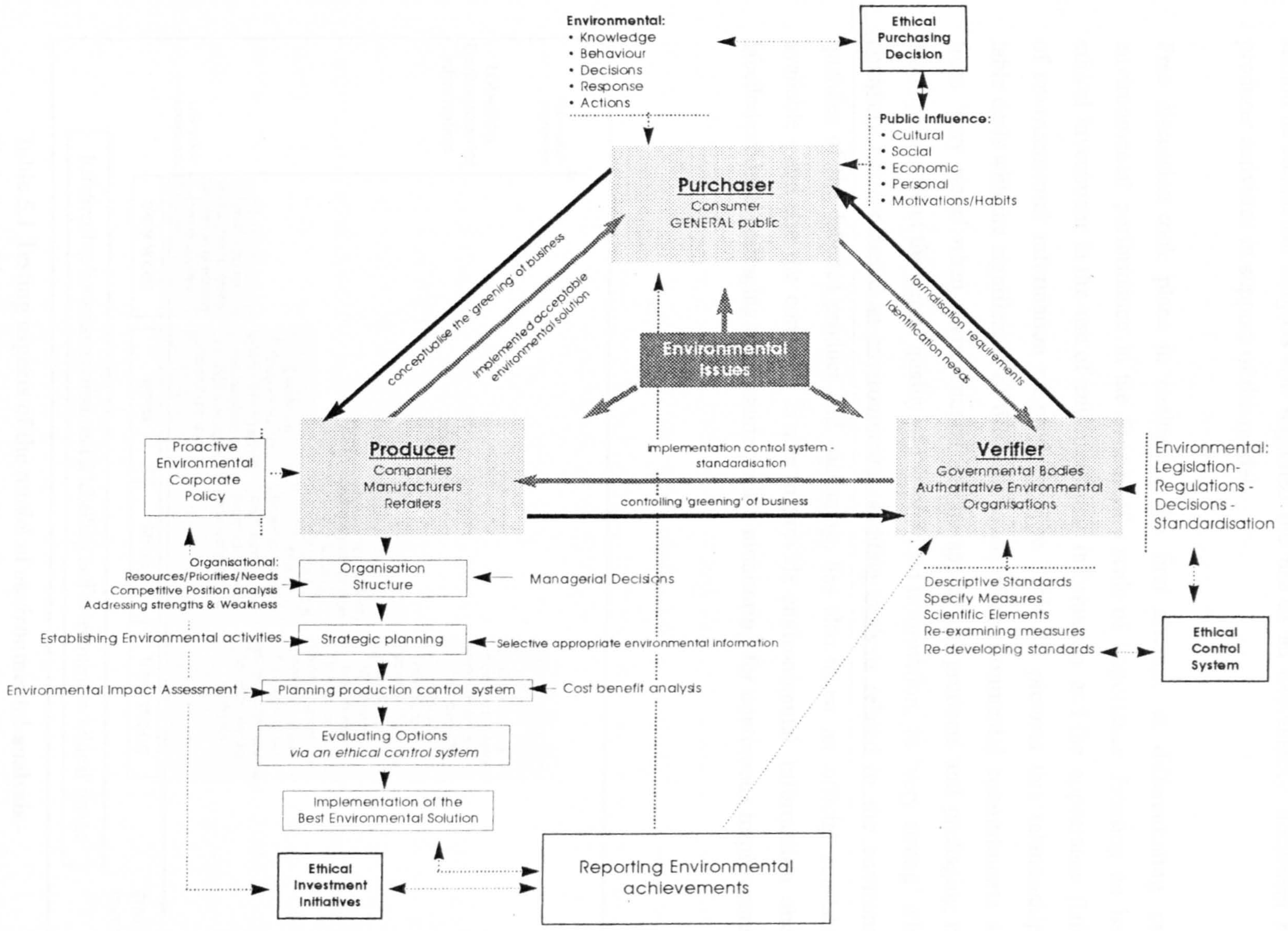

Figure 5.1. First format of the model of environmental analysis - *Network of environmental activities and ethical investment at corporate level* Source: ***'Environmental Business Strategy : A new model for development'*** refereed paper presented at conference 'Whose Values? - Ethics in the International Business Environment, organised by Thames Valley University, March 18-20 1996, London.

Considerations for improvement include subjects suggestion to provide more specific directions for the producer, in particular how the environmental activities should be established and the environmental impact assessment and how the cost benefit analysis should be conducted. Subjects also suggested the use of an explanatory document for the producer activities in support of the model.

Free discussion took place in evaluating the first attempt at differentiating products environmental performance in the format of a scale of importance focusing on issues of ethical investment in the use of environmental information and the appearance (labelling) of environmental information on products. The Table 5.1 pictures this relationship. The table deals with the significance of different levels of environmental commitments starting from 'very weak' when environmental claims appear on products and packaging making assumptions about the actual quality of the provided information, to 'very strong' when the company has conducted an environmental auditing analysis related to the environmental qualities of the labelled product and packaging; has also taken an official eco-label - if available - and also the company is able to provide environmental information about the labelled product/ packaging to consumer; while monitoring for continuous improvements.

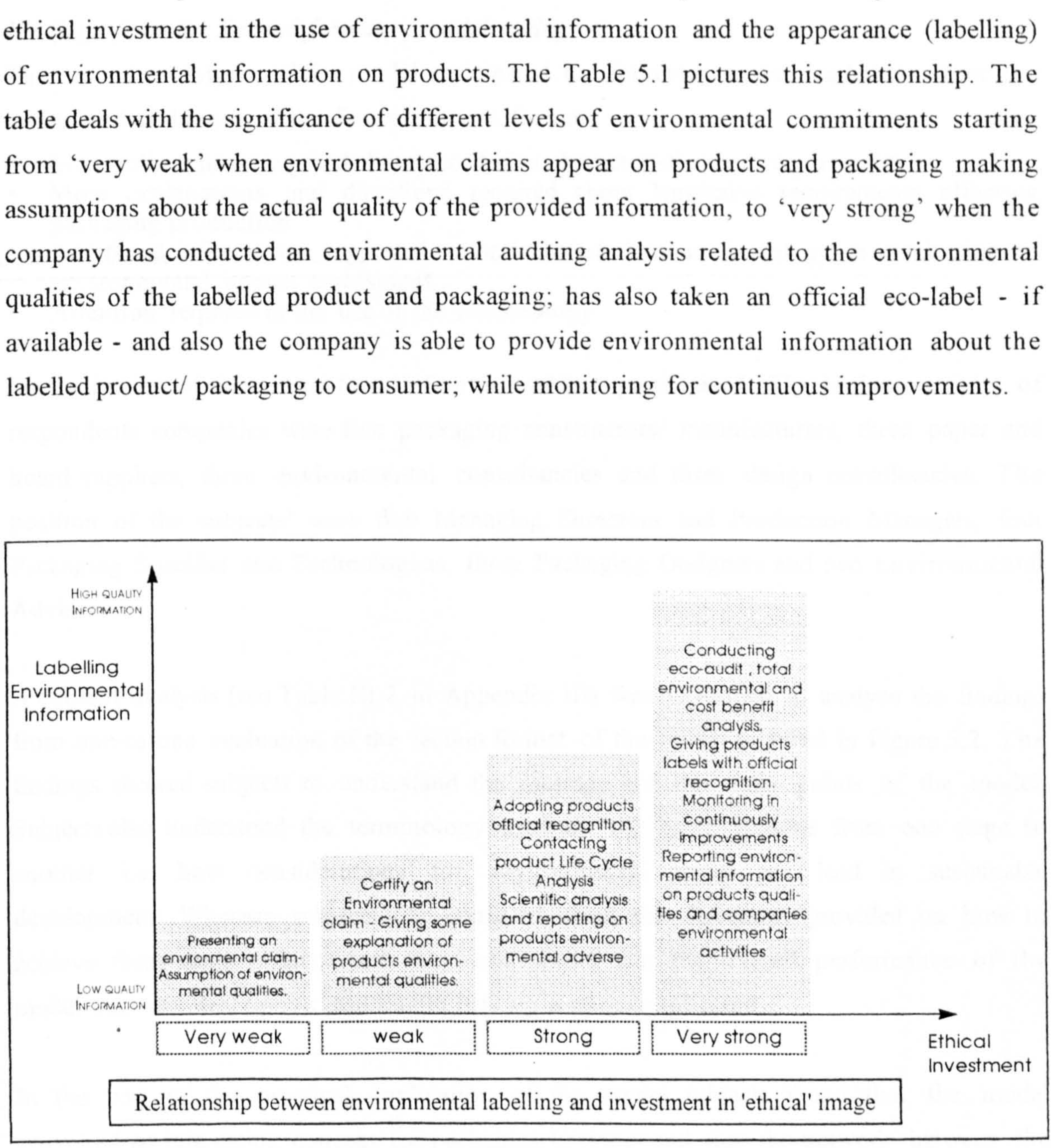

Table 5.1 Testing aspects of the model of environmental analysis -
Variation of business environmental performance. First format

Source: ***'Environmental Business Strategy : A new model for development'*** refereed paper presented at conference 'Whose Values? - Ethics in the International Business Environment, organised by Thames Valley University, March 18-20 1996, Park Court Hotel, London

The responses of the four subjects who commented on the representation of the relationship between environmental labelling and investment in 'ethical' image were positive. Their comments included '*it is a good indication of how many products with various environmental performance can still claim environmental credentials*' and that *'the table demonstrates a way of thinking about how to differentiate products environmental performance, and it will be helpful if it could have more information to assess and evaluate environmental products characteristics'.*

Findings from the Second format of model testing

The second prototype of the model anticipated the following recommendations from the testing and evaluation of the first prototype format.

- More information required about eco-design characteristics and requirements.
- More explanations and directions required about legislative requirements affecting packaging production.
- Additional information suggested to be included about methodology in conducting an environmental impact assessment.
- Attention required in the use of the terminology.

For evaluation of the second format fourteen subjects participated. The business activity of respondents companies were five packaging constructors/ manufacturers, three paper and board suppliers, three environmental consultancies and three design consultancies. The position of the subjects' were five Managing Directors and Production Managers, four Packaging Specifier and Technologists, three Packaging Designers and two Environmental Advisors.

A content analysis (see Table III.2 in Appendix III) was performed to analyse the findings from one-to-one evaluation of the second format of the model pictured in Figure 5.2. The findings showed subjects to understand the message and the main points of the model. Subjects also understood the terminology used and the basic relations from one stage to another i.e. how considerations for environmental issues can lead in sustainable development. Whereas subjects felt confused about the directions provided on how to achieve these main points. And, they commented that the overall performance of the model was very descriptive resulting in making it overcomplicated.

In the part of the practical application of the model subjects found that the model provoked an interesting concept for packaging business and that the network between the requirements for the *'quality of life'* with the *'quality of management'* was realistic and good interpretation.

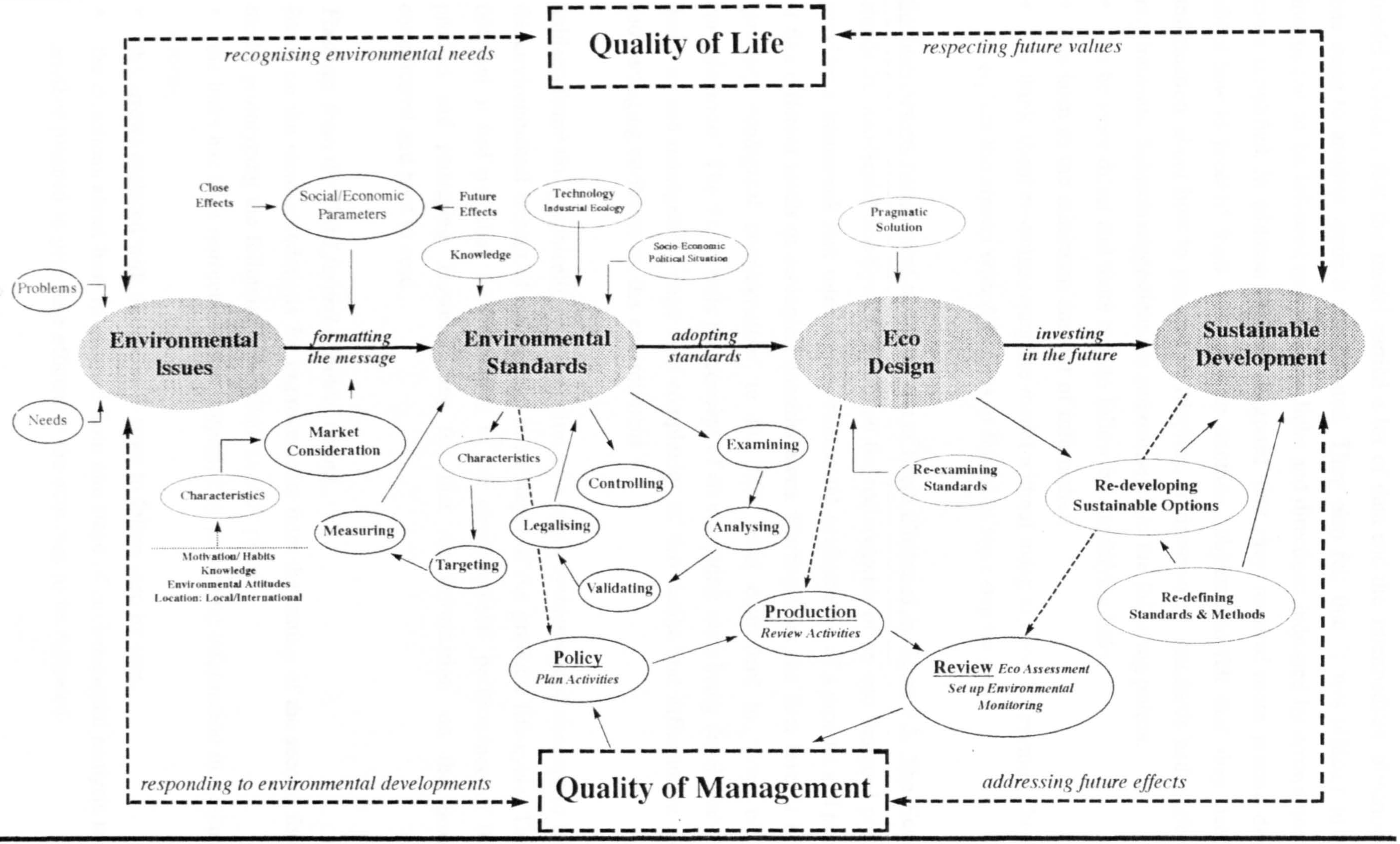

Figure 5.2. Second format of the model of environmental analysis - *A strategic Plan for A holistic Eco Design implementation*

Source: 'Eco-Design- You have to believe it to be true?' refereed paper presented at Worldesign '96 Conference. 'Alternatives Realities', organised by the Industrial Society of America - IDSA, September 18-211996, Dolphin Hotel, USA

However, subjects indicated a number of disadvantages for the effectiveness in use of the model including that the model carried a lot of data and the intermediate directions from one stage to another made it complicated. They also felt that it was difficult to use the instruction to be followed and that the links and directions indicated by arrows need to be more simplified. In addition subjects suggested that they required more precise directions about how to proceed from one stage to another Subjects also felt that they need more information about how to proceed in adopting environmental standards and performance requirements. Subjects suggestions are summarised into the following points.

- To be more direct and more easy to follow by simplifying links.
- To keep to the minimum amount of information.
- To think about re-constructing the model without using arrows. To examine the option to replace the arrows with directions to follow in rows step by step.

Six interviewers commented about the use of Eco/S illustrated in figure 5.3. The Eco-S that stands for Eco-Scale/ Eco-System is built on the requirements of an eco designed product, it provides a framework that rates the environmental performance of a product and packaging at five different levels of ecological considerations. Starting from the first level it applies a *'primary ecological consideration'* to the fifth level equivalent to *'deep ecological consideration'*. The Eco-S tests the concept of an eco-rating scale being developed to assist designers and managers to cope with complexity of eco design and differentiate products and packaging attributes on the environment.

Subjects found this graphically representation of a rating system a good concept to addresses the environmental impact of the product in all stages of the products life-cycle. They also felt that it had potential for evaluation of the environmental performance of the final product and packaging. However they felt that the information on the boxes was complicated and hard to read.

Findings from the Third format of model testing

Based on the recommendations for improvements from the testing of the second format of model prototyping the following modifications took place:

- the links has been restructured and simplified by presenting information in a tabular form,
- the arrows replaced with directions in rows to follow step by step,
- the directions about how to proceed from one stage of environmental analysis to another planned to prioritise efficiently the activities to be followed.

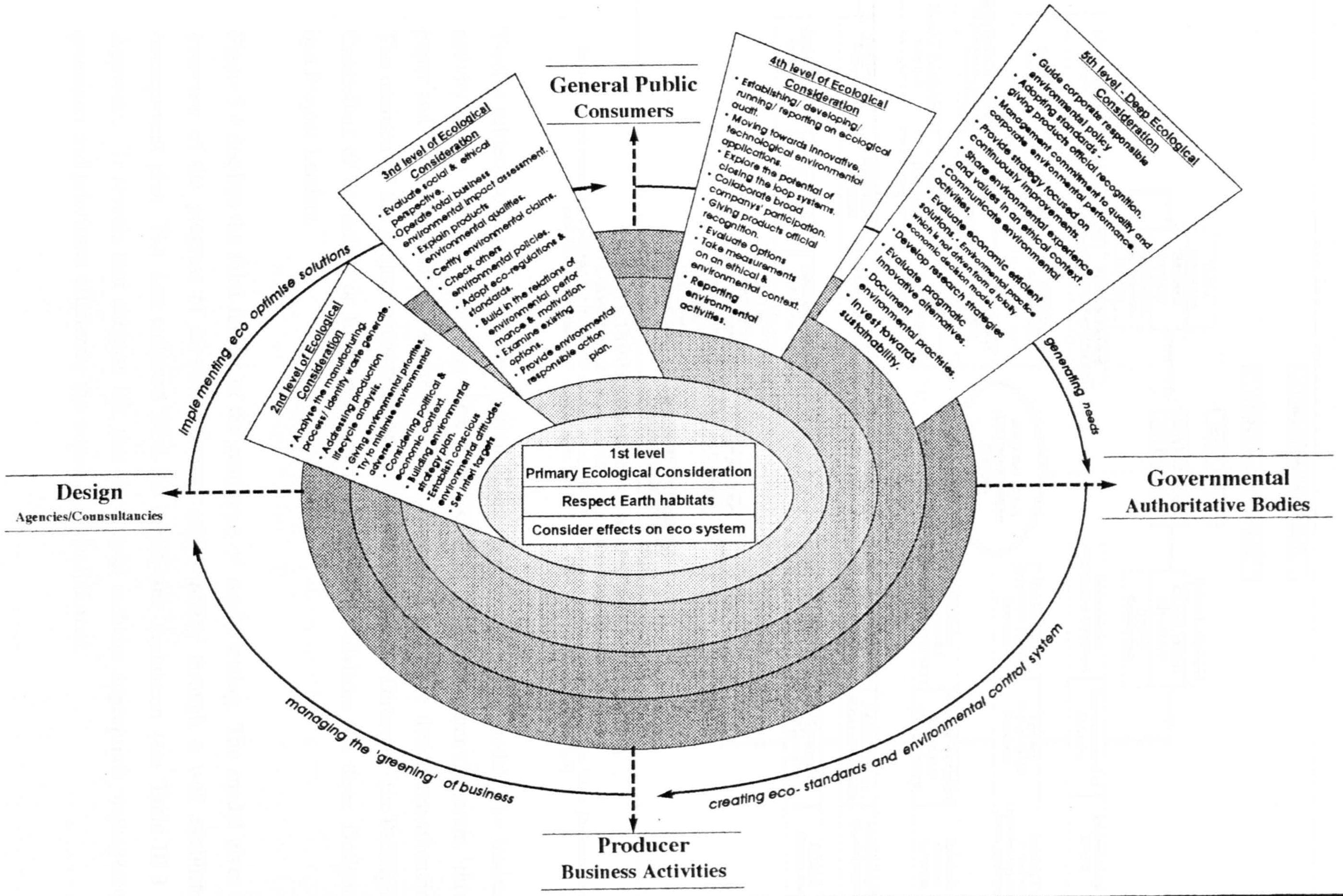

Figure 5.3. Testing aspects of the model of environmental analysis - *Variation of business environmental performance. Second format.*

Eco-S / The scales of eco-rating assessment Source: 'Eco-Design- You have to believe it to be true?' refereed paper presented at Worldesign '96 Conference. 'Alternative Realities', organised by the Industrial Society of America - IDSA, September 18-211996, Dolphin Hotel, USA

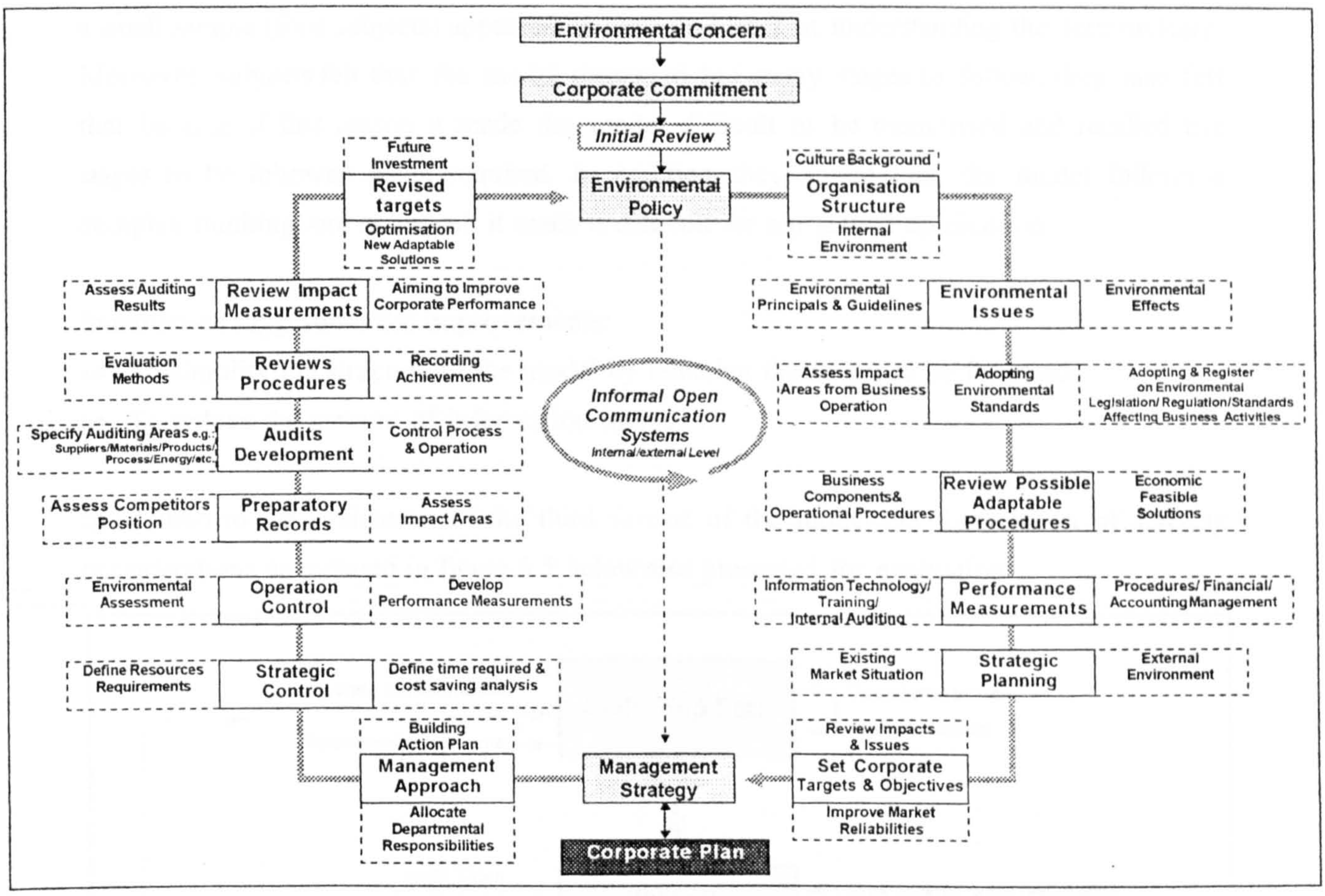

Figure 5.4. Third format of the model of environmental analysis
- Development of an Environmental Management System
Source: 'Environmental auditing for products market acceptability', refereed paper presented at the '1996 Business Strategy and the Environment ' Conference. 19-20 Sept. 1996, University of Leeds, UK

Twelve subjects took part for the evaluation of the third format of the model. The business activity of the subjects' companies were four packaging constructor/manufacturers, three paper and board suppliers, four environmental consultancies and three design consultancies. The position of the subjects were three Managers and Production Directors, six Packaging Controllers or Specialists or Engineers, two Environmental Advisors and three Designers and Project Leaders.

Figure 5.4 displays the third format of the prototype of model testing. The model gives an overview of the progress of an environmental action policy through a well established management plan. The data collected from the one-to-one evaluation (see Table III.3 in Appendix III) reveals that subjects felt that the model includes appropriate management principles and prioritises efficiently the activities to be followed.

The quality of information also found of a satisfactory level. However subjects felt that the amount of data included was more than required for the model to operate efficiently and for a small sample (four subjects) appeared to have problems in understanding the terminology. Moreover, subjects felt that the model presented too many stages to follow, they also felt that because of this reason it made the model difficult to be memorised and recalled the stages to be followed when required. In addition they found that the model follows a complex thinking and as a result it made it difficult for a practical application.

Summarised suggestions for improvements:

⇒ To simplify the structure of the model by reducing the stages to be followed.

⇒ To reduce the amount of information included.

In addition to the evaluation of the third format of the model the formulation of auditing considerations as pictured in figure 5.5 below also presented for evaluation.

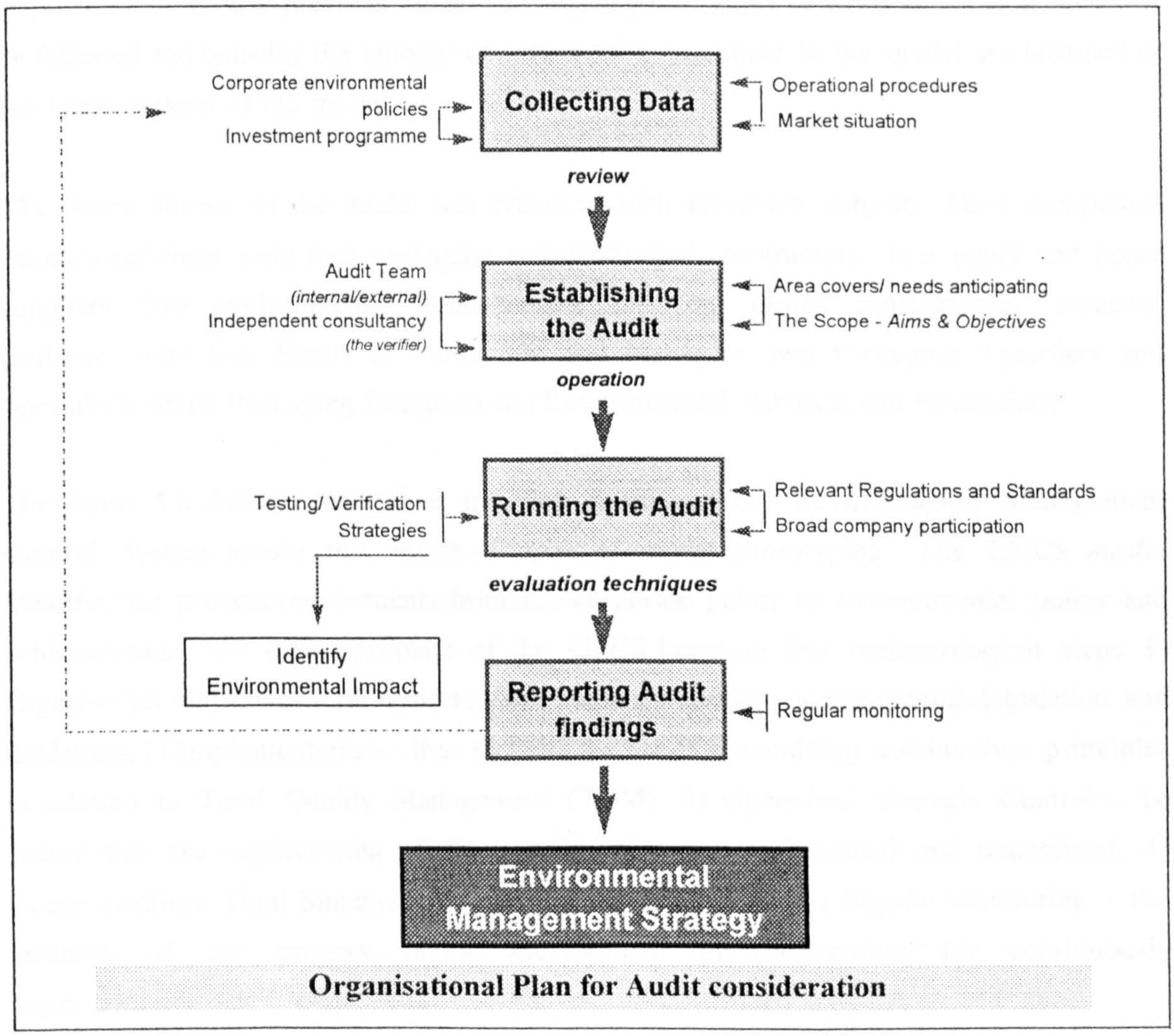

Figure 5.5. Testing aspects of the model of environmental analysis - *Audit*

Source: 'Environmental auditing for products market acceptability', refereed paper presented at the '1996 Business Strategy and the Environment ' Conference. 19-20 Sept. 1996, University of Leeds, UK

The five subjects that commented on it, felt that the auditing considerations accompanied the model are in a good structure and the auditing procedures are clear. They also commented that the framework of the '*Organisational Plan for Audit consideration'* felt that it was in a more simplified format than the main model.

It should be also mentioned that the additional comments offered by five subjects emphasised that the model had potential for practical application if it follows a more simplified structured. One subject indicated that where the model touched upon appropriate areas of environmental management system it has a similar base to BS and ISO.

Findings from the Fourth format of model testing

For constructing the fourth prototype format of the model the same management principles and priorities have been kept as in the previous model since it has been found that subjects were satisfied with these interpretations. However, recommendations made for improvements on the previous model for reducing the stages of environmental analysis to be followed and reducing the amount of information presented in the model are included in the latest version of the model.

The fourth format of the model was evaluated with seventeen subjects. Their companies business activities were four packaging manufacturers/ constructors, four paper and board suppliers, five environmental consultancies and four design consultancies. Subjects' positions were four Heads of Production and Managers, two Packaging Specifiers and Specialists, seven Packaging Designers and Environmental Advisors and Researchers.

The figure 5.6 follows introduced the first format of the Environmental Management Control System *model* and, fourth format of model prototyping. The EMCS *model* identifies the process requirements from the corporate policy to environmental policy and achievements. The basic approach of the EMCS based on five methodological steps 1) Organise/Set Objectives - relevant to the companys' policy environmental legislation and guidelines, 2) Implementation - that includes the use of eco-auditing and involves principles in relation to Total Quality Management (TQM), 3) Operation/ Strategic Control - to ensure that the requirements of the specific plan are implemented and maintained, 4) Documentation/ Final Statement - reporting the findings and 5) Regular Monitoring - the feedback of the process should incorporated in programmes for continuously improvements.

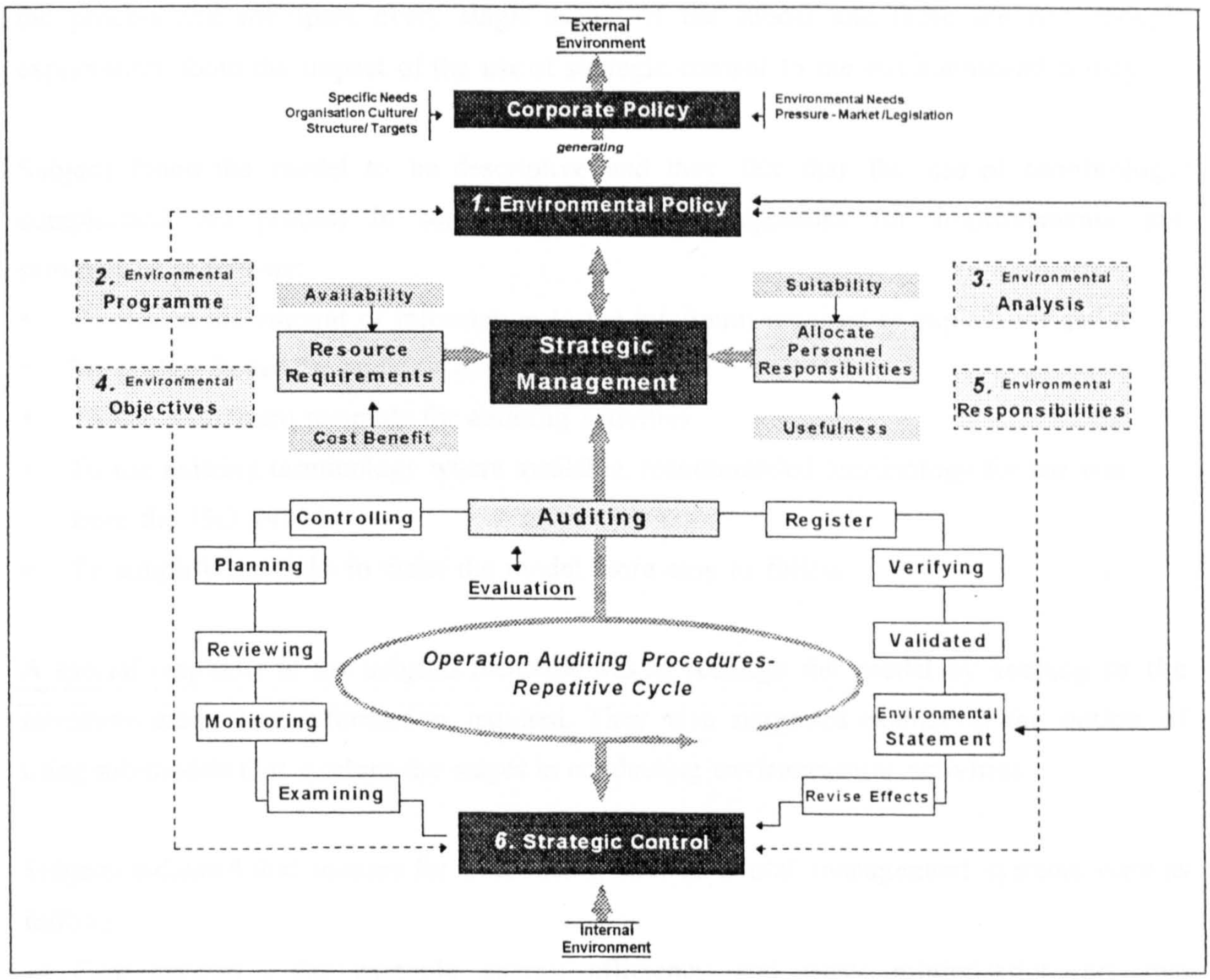

Figure 5.6. Fourth format of the model of environmental analysis - ***The EMCS model. First Format An operation process statement.*** Source: ' Building Eco-Performance: A strategic management plan' refereed paper presented at The 8th International Forum on Design Management Research and Education. Nov. 2023 1996, Barcelona, Spain

A content analysis (see Table III.4 in Appendix III) of the data collected from one-to-one evaluation showed that the level of user understanding of the model was satisfactory. Subjects indicated that they found clear the directions, good interpretation of the links between the presented data and useful the information material. In addition subjects felt that the format of the presented information was clear and easy to follow from one stage to another. They also pointed out that the model had a lot of potential for practical application. Furthermore subjects found the model to present an interesting concept with aspects close to the ISO standards on environmental management systems but, formatted very differently.

Moreover subjects still felt that the amount of information included can be reduced. They found it difficult to memorise and recall the presented information and the stages to be followed. Other points of subjects dissatisfaction included that it takes time to understand

the process and anticipate every single aspect of the model and there are not enough explanation about the impact of the use of strategic control to the environmental policy.

Subjects found the model to be descriptive and they felt that the use of terminology complicated the process in some degree. Their suggestions for improvements are summarised as follows:

- To reduce the amount of information to the minimum required to explain the point.
- To explain better the auditing procedures.
- To use a different template for auditing activities.
- To use existing terminology where available, recommended terminology for use was from the ISO 14001.
- To simplify the links to make the model more easy to follow.

A special emphasis in the subjects feedback was to redesign the model by keeping to the minimum amount of information required. They also suggested examining the option of using sub-models that explore the stages in conducting environmental activities.

Subjects indicated that reasons for introducing environmental management systems were as follows:

⇒ Cost savings - for example energy efficiency and waste minimisation · are two environmental areas in which cost savings are regularly achieved.
⇒ Market competitive advantages - profiling a good environmental performance for an organisation can give marketing opportunities arising from the 'green' consumers preferences.
⇒ Reducing current and future environmental liabilities - complying with environmental legislation and standards.
⇒ Positive response to public concern for business environmental commitments.
⇒ Good environmental records provide good reputation for the company to attract investors and secure insurance costs.
⇒ Environmentally responsible corporate image - well managed environmental activities appeal positively to shareholders, employees, pressure groups and media.

Findings from the Fifth format of model testing

For the fifth format of model prototyping twelve subjects took part. Their companies business activities were three packaging manufacture/ constructors, two paper and board suppliers, three environmental consultancies and four design consultancies. Subjects' positions were four Managers and Heads, three Packaging Specialists and Controllers, two Environmental Advisors and three Packaging Designers. The model designed for the fifth evaluation is pictured in figure 5.7 and called Measuring Environmental Products Acceptability (MEPA) *model.*

Chapter 5. Investigation Stage: Phase A. *Initial model formulation and Development*

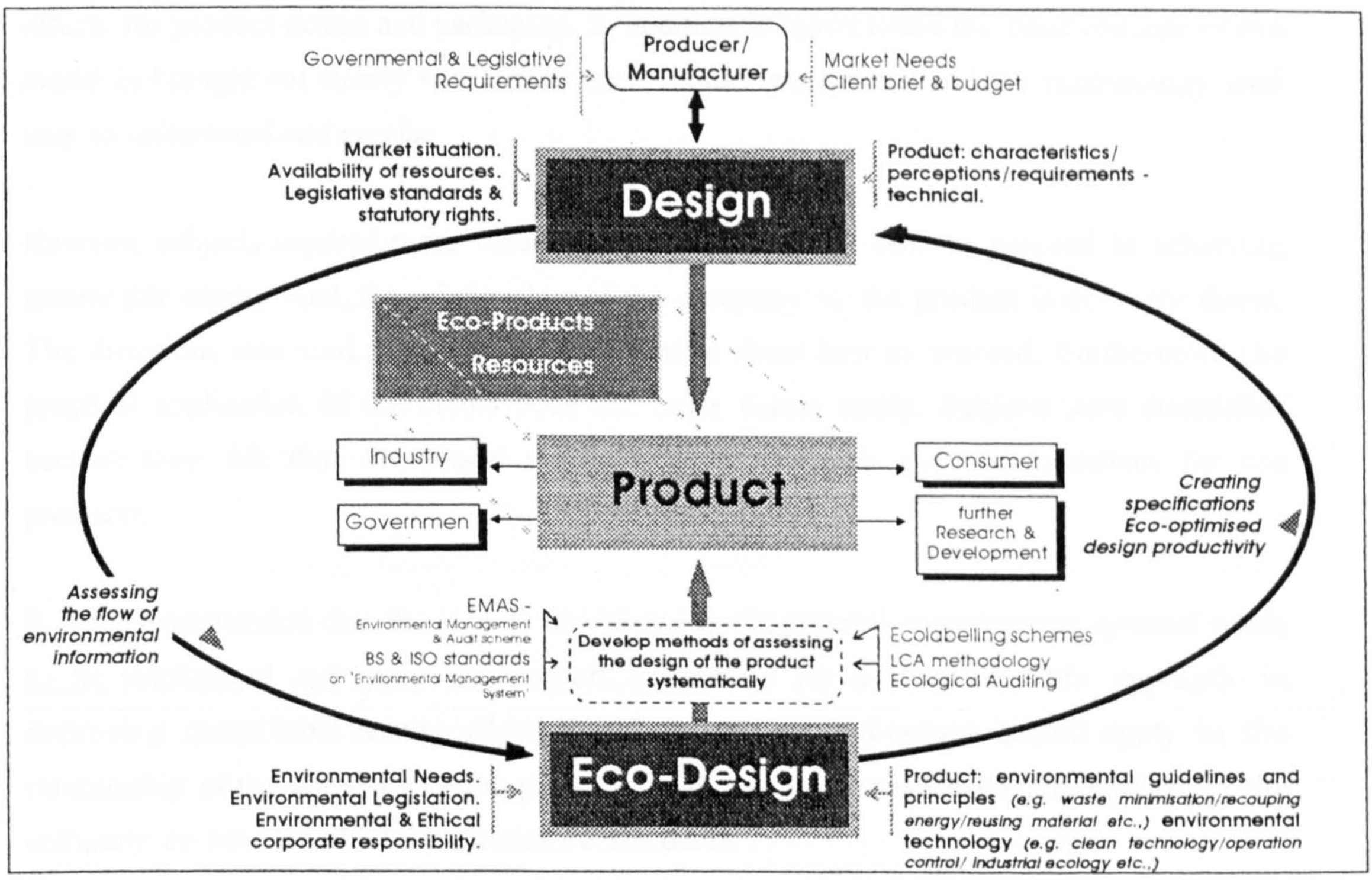

Figure 5.7. Fifth format of the model of environmental analysis. - MEPA *model - Measuring Environmental Products Acceptability* Source: 'Environmental auditing and labelling systems. An environmental identity for products market acceptability' refereed paper presented at The European Academy of Design 'Contextual Design/ Design in Context' conference, 23-25 April 1997, Stockholm, Sweden

The idea for formulating the MEPA was to synthesise a model that emphasised the design approach to products environmental requirements. In particular, the intention for producing this format of the model was to be included as a sub-model of the previous model for design considerations - *as the aim of the research was to produce a model that relates eco-design specifications with companys' environmental management activities.* The MEPA model prototyped an overview of the process from the traditional design to eco-design. The model focuses on the development, leading towards the creation of products environmental specifications and aiming to generate considerations about environmental options for best environmental practice that should be part of every early stage in creating a product.

The findings from the content analysis (see Table III.5 in Appendix III) revealed that the design considerations were easy to understand and subjects found interesting the conceptual modelling of eco-design characteristics and good quality of the presented information.

Subjects also found appropriate the comparison of eco-design with traditional design and the effects for product design and packaging. In addition, subjects found the basic concept of the model be brought out clearly with directions and links transparent and the terminology used easy to understand and precise.

However subjects required more detailed explanations about how to proceed in achieving measurable results. And, the relationship of the company to the product is not very direct. The directions also need more detailed explanation about how to proceed. Furthermore the practical application of the model does not come across easily. Subjects were dissatisfied because they felt that the model was lacking in providing specific guidelines for the producer.

It was recommended that the role of EMAS and environmental management systems needs to be emphasised and more explanation is required for a more realistic approach in improving quantifiable results. Also, considerations and indications should apply in the relationship of the company to the product. Finally, more explanations are required for the company on how to achieve performance standards.

Based on the additional comments that subjects offered during the free discussion about their business environmental activities, packaging business sustainability was defined in the following terms:

⇒ Reducing production cost.
⇒ Using resources and energy more efficiently.
⇒ Using reclaimed and renewable resources instead of finite ones.
⇒ Reducing running costs.
⇒ Reducing disposal cost at 'end-of-life'.
⇒ Minimising waste; managing waste and recycling.
⇒ Better business management and loss control throughout the product life cycle.
⇒ Check supply chain on its environmental activities regarding the material handling and process.
⇒ Improving product qualities/environmental differentiation.
⇒ Increasing customer confidence and loyalty by environmental reporting and use of accuracy and honesty on product labelling.

5.4 Overall findings

The answers provided in response to the item asking the interviewee to specify by who he believed the model could be used, did not add anything of significant importance since all the answers indicated the same sequence and additional answer included comments such as by a governmental or standardisation body/verifier. For the EMCS model most of the answers were between the choice of an Environmental auditor *internal or external*, based on the preference of eight respondents and Environmental manager indicated by five respondents.

Evaluation of the free discussion from interview sessions indicated some areas of consideration for the further development of the model. It came clearly out during the discussion that the first priority for business for commercial success is to maximise profit and minimise cost in all stages of product life cycle - in that sense good environmental management is good management - as it can offer significant cost reduction. The Energy Efficient Office has estimated that most companies could save around 10% of their energy cost simply by good housekeeping and another 10% through simple measures paying back in under two or three years.[1] These savings go straight to the bottom line. Any improvements in the efficiency with which processes use material resources, or in re-use or recycling, produces a double saving - first by reducing the amount of material purchased, or purchased at lower prices, and second by reducing the amount of waste which has to be disposed of. The cost of most waste disposal has already been increased by the tighter controls in the Environmental Protection Act 1990.

In addition, environmental management (see chapter 2.8) could provide protection against future cost increase. Increases in taxes on energy, transport and waste disposal have been widely proposed to combat global warming. Companies that are currently undertaking action to reduce energy, resources and waste production - protect themselves against likely future cost increases and improve their competitive position in the market. Better environmental performance also improves a company's market attractiveness (see green marketing in chapter 2.2), respond to the media, environmental groups pressure, EU environmental requirements and subsequently to its stakeholders demands for environmental commitments. Banks and insurance companies are beginning to take a close interest in the possible environmental liabilities of their companies clients.

Less published but probably even more significant is the increase of environmental requirements imposed by large companies on their suppliers or contractors, through tender

[1] Personal communication with the Energy Efficient Office, March 1997.

specification. Environmental standards such as BS7750, ISO 14000 and the EC's Eco-Management and Audit scheme advocate this, so it is likely to increase rapidly as these standards are taken up by larger firms (like the quality assurance standards BS5750 and ISO 9000) and then become standard good practice across entire industries. Considerations should also be made when a company targets overseas markets where strict environmental requirements are in existence. For example in Germany where is it necessary to be recyclable or reusable, this is creating problems for British exporters whose packaging suppliers have not kept up. The German rules have been criticised as barriers to trade (Local Agenda 21 UK, 1993:14)

Testing theories vs Generating theories

The aim for creating different synthesis of environmental analysis models was to select the option with the most potentials for further developing. The evaluation of each format of the model generated specifications and considerations for inclusion in prototyping the next format of the model and so on. By testing theories it has possible to identify and interpret better the relationships within the systems that organisations operate. The boundaries of the system have been identifies in terms of the effects of the system operation in creating products and packaging that will be acceptable outside the system: that is the requirements from the user, buyer, specifier, verifier.

The research exercise of model prototyping deals with testing theories with the scope to generate theories for further testing. Mainly because the EMCS model was received positively and, appeared to be the solution with the most potential to be used in practice. Although the MEPA model which followed provided design considerations for inclusion in the structured of the final model but, did not add anything significant in generating new theories for further testing. Instead what it found essential at that stage was to plan further exploration of the potential of the EMCS model and test the suggested modifications for improvements (see chapter 7.2 follows).

While the factors that each of the format of the models that did not work considered in assembling the ones follow, the overall recommendations for improvements and the advantages pointed for each prototype format considered in formatting the final model.

It was noted that the format of the EMCS model prototype give a good description of the stages of environmental analysis to be followed, and in particular the EMCS was similar to the BS 7750 and ISO 14001. Recommendations were made for the EMCS *model* to appear

in more simplified direct format to make it easier to use. Recommendations were also made that the terminology should borrow terminology where existing, possibly from ISO; BS; and EMAS standards on environmental management systems to avoid confusion.

Further it was recommended to improve the connection from one stage of environmental analysis to the other, in a more direct format. The final formulation of the models should be concentrated on revealing and emphasising the main steps to be followed in the process of auditing the environmental impact of business operation and product design.

These observations are used in the structure of the final model.

5.5. Summary

This chapter examined five different prototype formats of the *model* of environmental analysis that this study recommends on the way to control and assess the environmental impact of packaging products' in relation to company's environmental activities. Based on the findings from one-to-one evaluation the EMCS *model* was revealed as the most advantageous format for the *model* of environmental analysis because it had the most potential to be used in a practical application. However recommendations for improvements and modifications had been made, these recommendations were explored further in one-to-one evaluation and discrete interviews at the final stage of the research.

Next is presented Phase B. (*investigation research stage*) the investigation conducted in the packaging business aiming to test theories relating to environmental auditing methodology and, to reveal new insights, knowledge and understanding about environmental activities and current practices in the packaging sector. In particular, the survey conducted in UK based packaging businesses aimed to identify areas of 'weakness' in the way that businesses conduct their environmental activities and where improvements in the operation and control system should be made. This material combined, with the findings of Phase A, aimed to provide specifications in the final formulation of the EMCS *model.*

CHAPTER 6. INVESTIGATION STAGE: PHASE B. PRINCIPAL INVESTIGATION *Examination of Packaging Environmental Management and Information Systems*

6.1 Introduction

This chapter presents the second survey that deals with environmental effects on business management and information system. In particular the investigation is directed towards underpinning methods that businesses are using to control and manage their environmental activities, in paper packaging sector. This chapter presents the formulation of the survey including the pilot stage, the instruments used for this investigation and the profile and selection of the participants. The results present the outcomes from each item of the questionnaire and correlation between the findings. The results of the survey are considered in building the *model* of environmental analysis and exploring options for auditing packaging design activities as a part of companies' environmental action plan.

6.2 Survey: 'Environ Info System'

Building a *'green'* culture for packaging businesses is not something new and there is a debate about packaging and packaging waste involving legislators as well as environmental groups and organisations. Methods to assess the environmental impact are emerging including LCAs at the material process, eco-labelling schemes at product level and the environmental audits and environmental impact assessment at company level. Packaging businesses have to deal with EMS standards and eco-auditing regulations (explained in previous chapters) in order to find a way to support, control and substantiate their environmental performance. But, *what are the realities of packaging business commitments to sustainability? Do they employ environmental management systems approach? What are the main motivations for companies' response in the environmental agenda?* and, *How do they audit their environmental activities? What are the implications for packaging design?*

The survey with the title *"Environmental Effects on Business Management & Information System"* - called on the website 'Environ Info System' - aims to invite answers to the above questions. The survey is also aimed to test theories related to environmental auditing methodology and to estimate packaging business activities towards environmental improvements and to compare proportions about how often, for example different environmental activities take place and whether the business activities are directed towards environmental improvements based on the size of the company (turnover/ number of employees). In particular the survey investigated what environmental activities packaging companies carry out and, how they address their environmental achievements. Also to

identify areas of 'weakness' in particular, where more environmental investment should be made and, in relation to the organisational system of business corporate activities to identify problems which have environmental implications in the operation and control system.

6.2.1 The formulation of the survey

The survey was conducted over a period of nine months from March 1997 to December 1997 and formatted in three stages. The first version of the survey (table V.1 in appendix V) was piloted (see piloted of the survey below) the second format piloted again and the third format of the survey was the final questionnaire that was sent out.

The survey was piloted by face-to-face interviews and through a web page located at <http://www.dmu.ac.uk/~esarri/Environ.html>. For the final format of the survey one hundred fifty members from the Institute of Packaging have been contacted by phone or by e-mail to check if they were willing to complete the questionnaire. The questionnaire was sent either by post with a covering letter and a stamp addressed envelope or by e-mail with reference to the web page address.

Details of the survey have been published in a letter in Design Week (DW 2 May 1997) and in IDFORUM (14 Oct. 1997) presenting the survey and inviting the readers to participate, motivating them to reply by promising that the results of the survey will be sent to all of those indicating an interest in the questionnaire after the completion of the study. The same promise was given to those contacted by phone or by e-mail.

On the web page design the answers were pre-coded, so when the respondent ticked one box it was linked to the coded answer pre-determined. But in the postal format of the questionnaire the codes are not indicated. However all of the items allow the respondents to add their own views, marked as 'other'. For that reason the codes did not appear in the postal survey version, to leave an open option to add and to code more categories in each reply.

Open items were used occasionally in the case where pre-determined answers cannot be given, to allow respondents to express their own views when they may have had no previous opportunity to do so - for example, *'what was the principal catalyst for the change of (environmental) policy?'* The reason for not using very often 'open' items was not merely because the analysis cannot be planned in advance. But, mainly because open items in a questionnaire design slow down answering by causing respondents to search their memory in order to recall, rather than simply recognise, the responses.

Rothwell (1993: 21) found open items discouraged respondents from answering, especially if they are uncertain what to say or have a poor command with the language.[1] Because of the extensive size of the questionnaire open items were minimised. However, to pick up interesting points not covered in closed-ended items, open items were placed towards the end of the provided list of stated choices inviting people to expand on their own views about how companies anticipate and plan for future trends on environmental product development. Also to invite information that might be missed out from the questionnaire design and to provide examples of best environmental practice.

For the development stages of the survey see Table 3.1 *Development stages of the survey*, in Chapter 3. Research Methodology.

Participants

To define the audience two questions were asked: *who is responsible for packaging design?* and, *who is involved in packaging production?* Packaging design could be offered by packaging manufacturers who have their own design studios, as a free service by independent freelance designers/ design consultancies often working direct with the manufacturer, and from advertising agencies. Pilditch (1976: 289), found that many designers, as well as manufacturers, like to think they know what people want. They have faith in intuition and experience. But seven out of ten products created on this basis fail. Even so the idea prevails. In a small local market this attitude is dangerous. As soon as wider areas are considered it becomes impossible. Research is necessary because the scale grows too big for anyone to believe that he can judge what customers want. It is needed not only to define markets, but also to determine and measure the function and form of products.[2]

Do packaging companies get advice from environmental standards and guidelines that are imposed. Do they use auditing methodology to control their environmental process and marketing environmental claims on packaging products; and how do they deal with assessing and auditing the environmental performance of packaging;

The survey was piloted world-wide. The first piloted format of the survey used simple *random* sampling from a specified list provided from the Chamber of Commerce Database the Environmental Industries Commission Guide to the UK Environmental Industry 1997, IDSA and DMI lists. For the re-piloting the sampling method used classified by Cohen et al. (1994:132) as *snowball*. In snowball sampling the researcher identifies a small number of individuals who have the characteristics that are required, these people are then used as

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[1] Rothwell, A. (1993) *'Questionnaire design'*, B3a Self-study pack series, De Montfort University, p 21

informants to identify others for inclusion and these, identify yet others.[3] The participants for piloting the survey were obtained from contacts made during attendance of events and conferences those people recommend others and so on.

For the main survey the participants were selected from *The Institute of Packaging Directory and Review 96/97*. The sampling method used is classified as *quota sampling* based on the definition provided by Cohen et al (1994: 132).[4] One hundred fifty members of the Institute of Packaging under the categories of paper packaging manufacturer, retailer, paper and board suppliers, design consultancy and environmental consultancies in packaging sector were contacted.

The pilot of the survey

Piloting was used for trying out the questionnaire on typical respondents and on people specialising in the area of design and environmental issues within design even if in some cases the questionnaire did not apply to them directly. For this purpose people are of similar ability and background to the target population contacted. For example, the draft version of the survey was piloted with environmental consultancies and business environmental advisors from Universities researchers (academics – not included in the main survey), in addition environmental and business organisations and designers (industrial, product and packaging). The pilot stage of the survey took four months. Group mailing were sent to design professionals; environmental consultancies and environmental organisations. E-mail and the web page design provided a world-wide sample in piloting the survey.

The survey tested how long it takes recipients to complete and to check that all items in the questionnaire and instructions are clear. It aimed to collect comments in order to re-formulate and re-phrase the format of the questionnaire concisely and precisely to be understood and to check if there are any missing parts in the activities list provided.

The survey has been located on the web site and a random two hundred emails have been sent to environmental consultancies, environmental managers and designers in different

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[2] Pilditch, J. (1976), Talk about design, Barrie & Jenkins Ltd, London, p 289
[3] Cohen L., and Manion L., *Surveys*, presented at Chapter 9, in the book The Open University (1994) *Improving Educational Management through research and consultancy*, Paul Chapman Publishing Ltd, London, pp 127 - 134
[4] Quota sampling has been described as the non-probability equivalent of stratified sampling. It attempts to obtain representatives of the various elements of the total population in the proportion in which they occur. Ibid.

countries for the first pilot stage. The first version of the survey (sample twenty respondents) was not separated into different sections and it was more confusing for the recipient to complete, it also took more time (about five minutes more) to fill the questionnaire. The first version of the questionnaire did not included any questions about the company size as the researcher knew this in advance. It was nevertheless indicated that considerations about the size of the companies should be included in the analysis. Thus, the 4th section changed to include questions that could provide precise information in the main survey about the company's size. Moreover it was pointed out that the list of considerations and/or activities which applied in some items should be expanded to include as many options as possible for the respondent to tick. In addition the background of the web page changed to require less time to load.

The revised version was re-piloted (18 responses collected) by using a specified list of contacts produced during the research process. In addition the piloting at that stage took place through interviews (for example with Chris Radway, Business Service Manager from Environ Leicester) and talk with experts, mainly academic environmental researchers and designers at the Chartered Society of Designers (CSD) forum for the re-launched CSD Green Committee (13th February 1997). People were asked to be critical noting any perceived ambiguity or lack of clarity for re-wording the questionnaire; change or adding parts. In the re-pilot of the survey it was indicated that the specified options offered in some items should be further expanded to include all the existing considerations. Also, values should be pre-recorded and efforts should be made to reconsidered the values inputs to be more precise and descriptive. It was also suggested that the questionnaire should be sent by post in addition to the web page as people may found it inconvenient to load the web page. (see table V.1 in appendix V for a copy of the survey and modification stages).

In the piloted stage the web page design was tested for its efficiency and practicality in use. For example, buttons have changed so when the respondent clicked one answer it is not possible to indicate another answer in the same item. During the pilot stage of the survey people complained that it takes time[5] to load a page on the internet or that they are very busy to look immediately. And people contacted through the e-mail preferred to print out the questionnaire, complete and send it by post. So a copy of the questionnaire accompanied the text on the e-mail that informed people about the web page was used for the final survey. The replies collected in the piloting and re-piloting stage of the survey

[5] Even if the design of the web page bear this in mind and is very efficient in the use of memory and background - load very quickly.

have been excluded from the final analysis. Mainly because according to Rothwell (1993:38) methodological purity requires to exclude such responses from the final analysis.[6]

Instrument

The instrument used in this investigation was a self-completion questionnaire (see Appendix V). The questionnaire consisted of thirty items, both open-ended and six or four - point scaled items and it was divided in four sections: (a) Personal views on business environmental debate, (b) Corporate Environmental profile, (c) Environmental Management approach, and (d) Feedback sheet - Personal details.

It was anticipated that the more structured a questionnaire is, the easier it will be to analyse. Youngman (1986) suggests the use of 'list' and 'scale' for a structured questionnaire. The 'list' implies in a selection of items offered for ranking and appear in the survey as multiple choice items. The 'scale' gives different scaling devices. The study applied both methods to formulate the questionnaire. List of different options or activities given after literature review and consultation with experts in the part of piloting and re-piloting the survey. The items also provided a scale of answers with wording at various points known as *Likert scales* after a prominent American management researcher who used them extensively (Likert, 1961).

The first section, personal views on business environmental debate, was concerned with personal interpretation by the respondents of the importance of environmental issues in packaging business operations. The purpose of this section was to seek opinions and motivations for companies to deal with environmental issues, sources of environmental information and how the respondents can define environmental practice. The items included in this section are as follows.

1) Do you believe that environmental issues are highly important in business operations?
2) What do you believe are the main motivations for companies response in the environmental agenda? *Provided answers for ranking included:* Ethical investment/ responsibilities. - Environmental Legislation/penalties. - Consumer Pressure/Green marketing. - Codes of Practice, EMAS/ BS 7750/ ISO 9000,14001. - Competitive position from other business environmental initiatives. - Environmental Profit. - Other(please state your opinion).
3) When did you first introduce environmental requirements on products and/ or services?
4) What proportion of information about environmental implications for business activities did you learn from each of the following sources? *Provided answer included:* College, Studies. - Conference/Exhibition. - Journal/Publications. - Clients requirements. - Other (please be more specific).

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[6] Rothwell, A. (1993) 'Questionnaire design', B3a Self-study pack series, De Montfort University, p 38

5) Could you please explain what environmental practice means to you? *Provided answers were:* Adopting environmental legislation and standards. - Support community environmental relation programmes. - Encourage customers to consider in depth the environmental implication of your business activities. - Integrate environmental management in corporate level. - Recognise environmental risks as part of the normal checklist of risk assessment and management. - Checking your suppliers approach to environmental standards/ official certificate. - Giving environmental information to consumers in an ethical context. - Other (please state).

The second section *Corporate Environmental profile.* concerned with organisation environmental activities in particular about implementation of an environmental audit review. The scaled items included are as follows.

1) When did your organisation start its initiatives to be environmental responsible?
2) Does your organisation have an environmental policy? (i.e. something in writing)
2.a) When was the policy formally established?
3) Could you please state what sort of environmental commitments the particular policy implies ? For example: Compliance with Legislation. - Specific management aspect related with corporate policy systems, e.g. BS 7750. - Particular area of organisation operation, e.g. energy and resource conservation. - Particular area of organisation operation, e.g. energy and resource conservation. - Waste management audits. - Suppliers audits. - Quality control audits. - Verifying systems. - Other (please specify).
4) Has your organisation changed its environmental policy over the last decade?
4 a) Can you recall when it was?
4 b) What was the principal catalyst for the change of policy?
5) Which of the following describes best for you the term 'environmental audit'? *Provided answers were:* A management tool to control business environmental activities. - An environmental analysis process in corporate level. - A business commitment to safeguard compliance with environmental legislation and standards. - A way to talk and present companys' environmental performance. - A format to check business environmental impact. - Other (please state).
6) Does your company hold environmental audits which address the impact of its whole operation?
6a) Could you please state how frequently does your company have environmental audits?
7) Does your company hold a particular audit for individual products or services?
7a) Could you please state how frequently your company has environmental audits for products and/or services? *If the answer is positive, please give an example:*
8) Which of the following difficulties do you most encounter when implementing an environmental audit review? For example: Difficulties to collect appropriate data. - Difficulties to control the whole process. - Difficulties to find the appropriate staff. - Difficulties to cope with resources and cost involved. - Clear guidelines not available. - Other (please state).

The third section *Environmental Management approach* was concerned with the human resources used by the company to carry out environmental activities also the format and the sequence of which the company present (if it presents) its environmental activities and to what particular groups. The items included are as follows.

1) How does your company carry out its environmental activities? *Provide answers were:* We employ an external environmental consultant. - We have an environmental

management team in place. - We collaborate with external environmental auditors. - We collaborate with independent governmental bodies/ verifiers. - Other (please state).
2) Does your company present its environmental activities/ performance?
2.a) If your company is presenting its environmental performance, could you please state to which of the following groups? *Provide answers were:* Stakeholders. - Board of the Directors. - Employees. - Governmental Bodies. - Interested parties. - General public. - Other (please be more specific.)
3) Does your company publish an environmental review statement?
4) What is the format of the presented information? *Provide answers were:* Environmental Report. - Leaflet. - Fact sheet for individual products or particulars activities. - Other (please state).
5) How often you report environmental activities? *Provided two columns table. First column indicated the* Sequence - e.g. Annual / Twice a year/ Monthly/ Weekly *Second column indicated the* Format - In what publication format?
6) Is it possible to send me [the address provided at the front page] a copy of your environmental report or other environmental statements publications;
7) Your Own View: How can companies anticipate and plan for future trends on environmental product development? For this last open question you can give your opinion or provide examples of best practice. Please feel free to make any recommendation.
8) Any additional comments are particularly welcome.

The fourth section *File: Feedback sheet* asked the respondents to complete their personal details company's activity and size. The respondent was also asked if they want to remain anonymous, if they are interested to co-operate again during the process of the research and if they wish to be informed about the results of the survey.

A copy of the web page design, and a copy of the post type questionnaire placed in appendix IV.

6.3 Analysis of the survey

Sixty four subjects took part in this investigation. The business activity of the respondents presented in figure 6.1 were from the paper packaging sector.

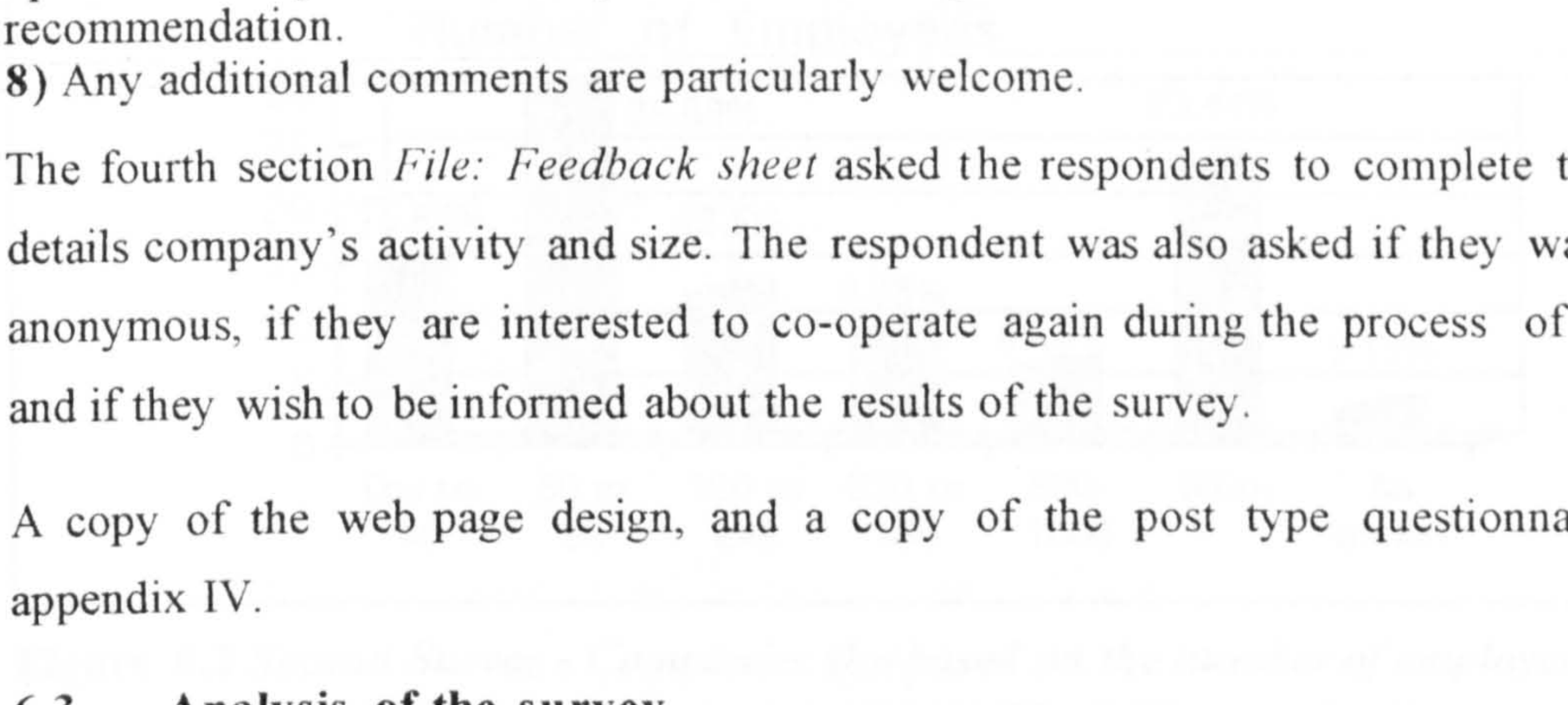

Figure 6.1 ***Second Survey - Business activity of the subjects***

The largest number of responses were received from Paper and Packaging manufacturers (thirty five subjects equivalent to 54.69%) – the job title of respondents included Business Manager, Environmental Health and Safety Executive, Research and Development Manager, Head of Design. Ten were Packaging designers (15.63%) – including in-house designers and design consultancies in paper and board packaging. Ten were Consultancy (15.63%) – this category select opinions from environmental consultancies in the packaging business sector. Other (seven equivalent to 10.94%) – this category implies people that did not complete the business activity on the question sheet or organisations that deals with the packaging retailers and/or environment. Two were Paper and board suppliers (3.13%) – including Environmental Advisor and Sales Manager.

The Figure 6.2 below presents the size of packaging business that responded to the survey based on the number of employees and the turnover of their companies.

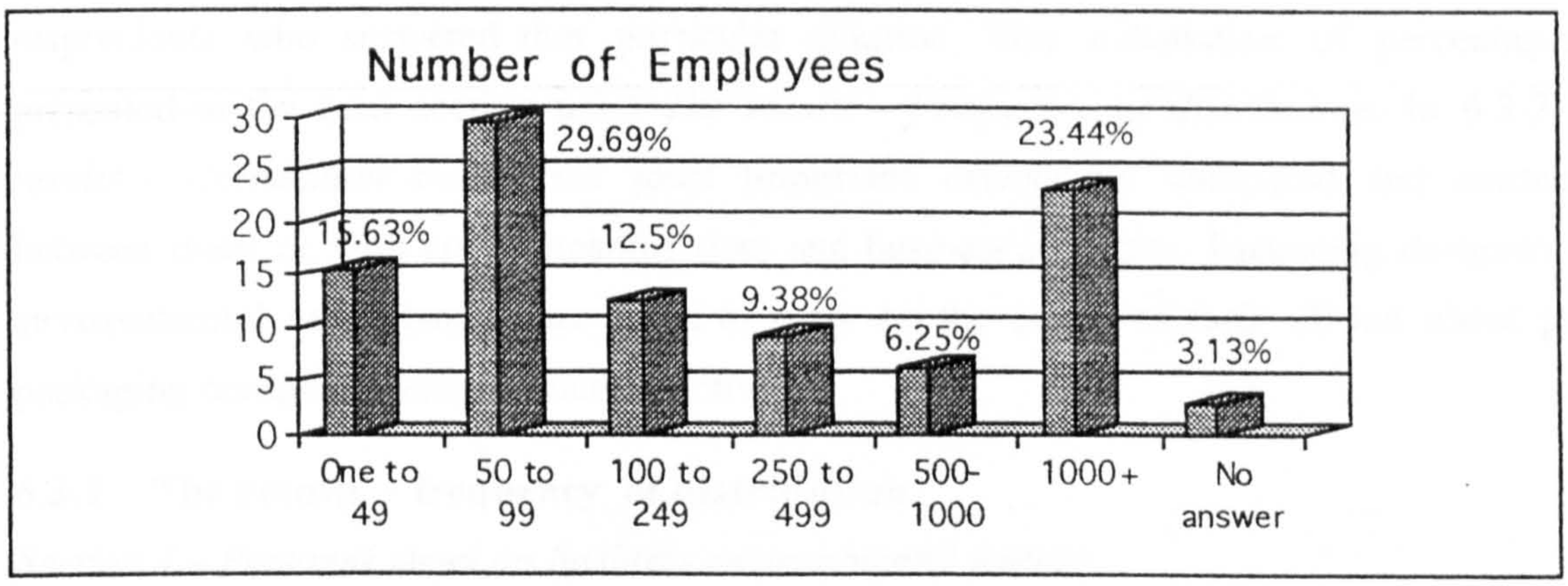

Figure 6.2 ***Second Survey - Companies size based on the number of employees***

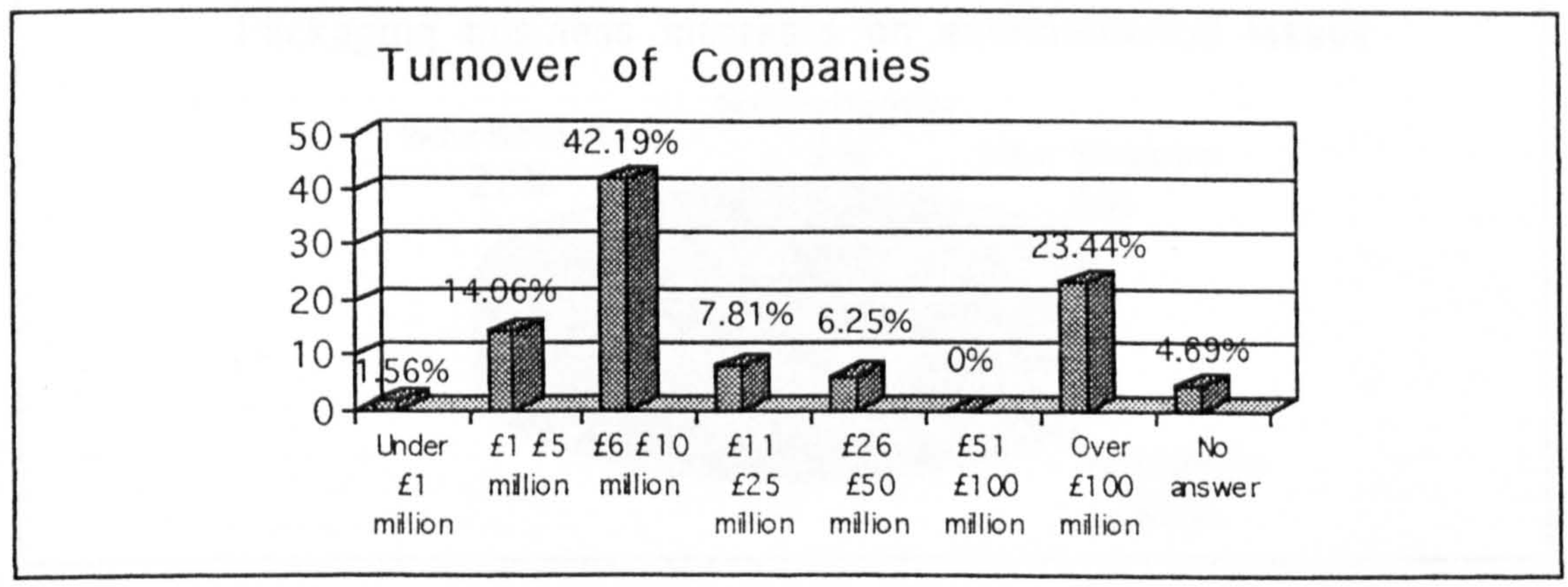

Figure 6.3 ***Second Survey Companies size based on the turnover***

Figure 6.3 also indicates that the representative sample for small and big companies is well balanced and thus the findings are equally disseminated.

The response level was good in the 'closed' scaled items. But the response to open-ended items was generally limited in level and quality. Seventeen out of the sixty-four respondents

provided supplementary documents, such as annual environmental reports; companys' newsletter and environmental leaflet.

An attempt was made to identify any difference between big and small enterprises and different levels of environmental performance. Also, differences between business activities in the use of environmental auditing and methodology for environmental developments with regard to packaging design.

The codes used to input data is for the purpose of statistical analysis and listed in the appendix V. The answers to 'closed' items rating from '1' for the most powerful answer - 'agree strongly' or 'very likely' - to '4' or '6' for the opposed answer.

For items where a ranking was requested in a priority scale, the most important *key driver* percentages are calculated from the total respondent numbers, not just from the number of respondents who answered that particular question. This calculation of percentages is presented in the next section 6.3.1 *The results - Frequency of distribution.* In 6.3.2 *The results - Correlation studies* the most important drivers are compared and contrasted between them or with are companies sizes and business activities. Packaging designers and environmental consultancies are asked to reply on the behalf of their clients about paper packaging companies environmental activities.

6.3.1 The results - frequency of distribution

Section 1.- Personal views on business environmental debate

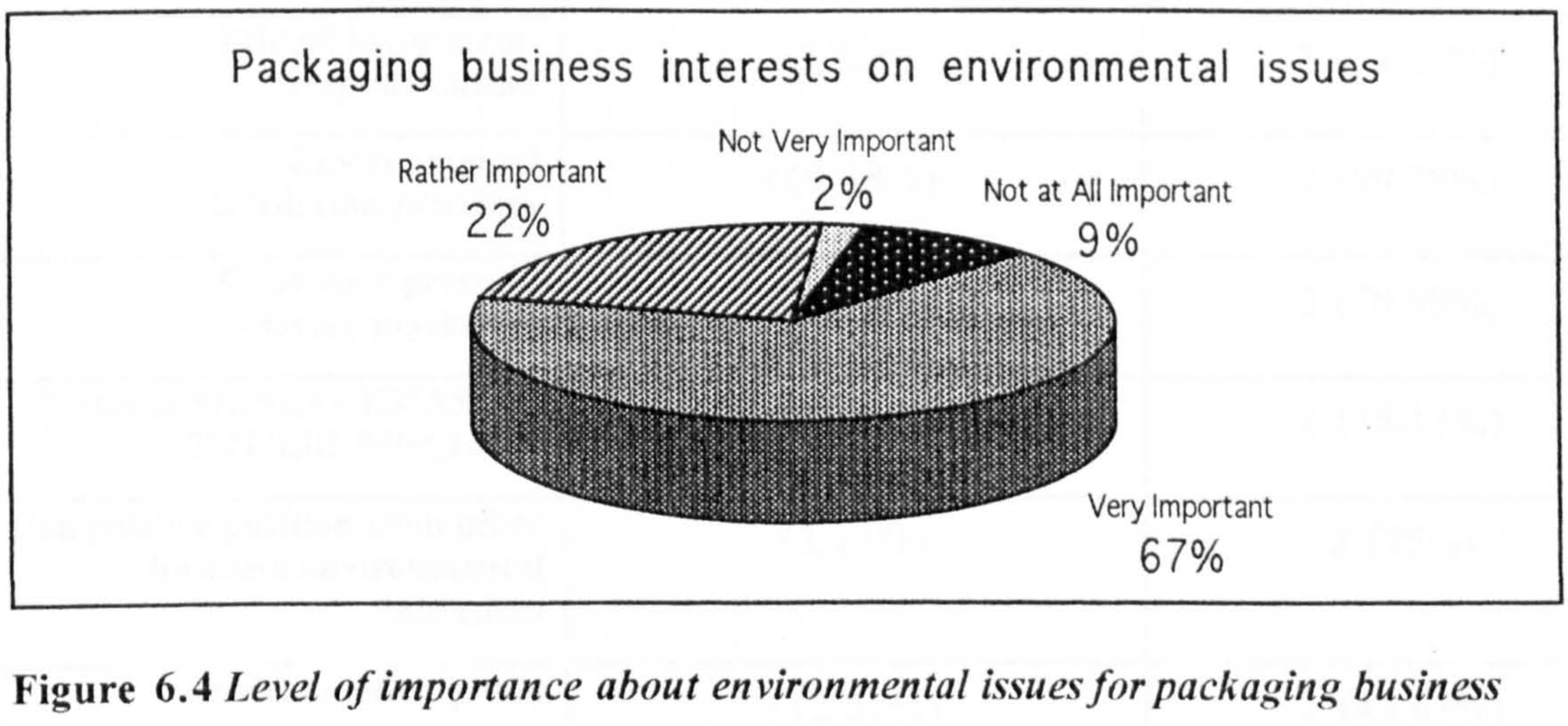

Figure 6.4 ***Level of importance about environmental issues for packaging business***

The majority of subjects found environmental issues to have a high profile of importance in paper based packaging business (forty three said *'very important'*). While six found environmental issues to be *'not at all important'* (see figure 6.4) A reason indicated by a

Packaging Design Consultancy to be that: '*large companies are more interested on environmental issues while small companies do not express interest at the same level*'

From a specified list, respondents were asked to indicate the main motivations for companies response to the environmental agenda and rank choices in order of importance. The answer with the ranking as first preference was 'Environmental legislation/penalties' with thirty eight strongly agreed and the rest (twenty six) indicated the preference of '*tend to agree*' proves that packaging businesses no matter what size are very motivated about the implications of environmental legislation.[1]

The answers with more preference (ranking 2 - *'tend to believe'*) were 'green marketing' indicated by fifty-one respondents, followed closely by 'codes of practice - EMAS/BS 7750/ISO 9000,14001' pointed by fifty and 'competitive position from other business environmental initiatives' pointed by forty eight subjects'. That indicates paper packaging businesses interest to enhance a corporate profile based on market preferences, EMSs and competitors initiatives.

Bellow are the key findings:

- percentage of respondents who thought the selected motivation was the most important
- most popular ranking answer for the particular motivation

	Most important motivation	**Most popular ranking answer**
Ethical investment/ responsibilities	(9.38%)	2 (54.69%)
Environmental legislation/penalties	(59.38%)	1 (59.38%)
Consumer pressure - Green marketing	(12.50%)	2 (79.69%)
Codes of practice - EMAS/ BS 7750/ISO 9000,14001	(10.94%)	2 (78.13%)
Competitive position from other business environmental initiatives	(3.13%)	2 (75%)
Environmental profit	(12.50%)	2 (43.63%)

Table 6.1 ***Environmental motivations for packaging companies response in the environmental agenda***

[1] In particular about EU packaging and packaging waste Directive and Producer Responsibility industry Group targets - since the main survey conducted exclusive in paper packaging business based in UK.

Others include comments such as *'culture pressure'* coming from an Environmental Consultancy.

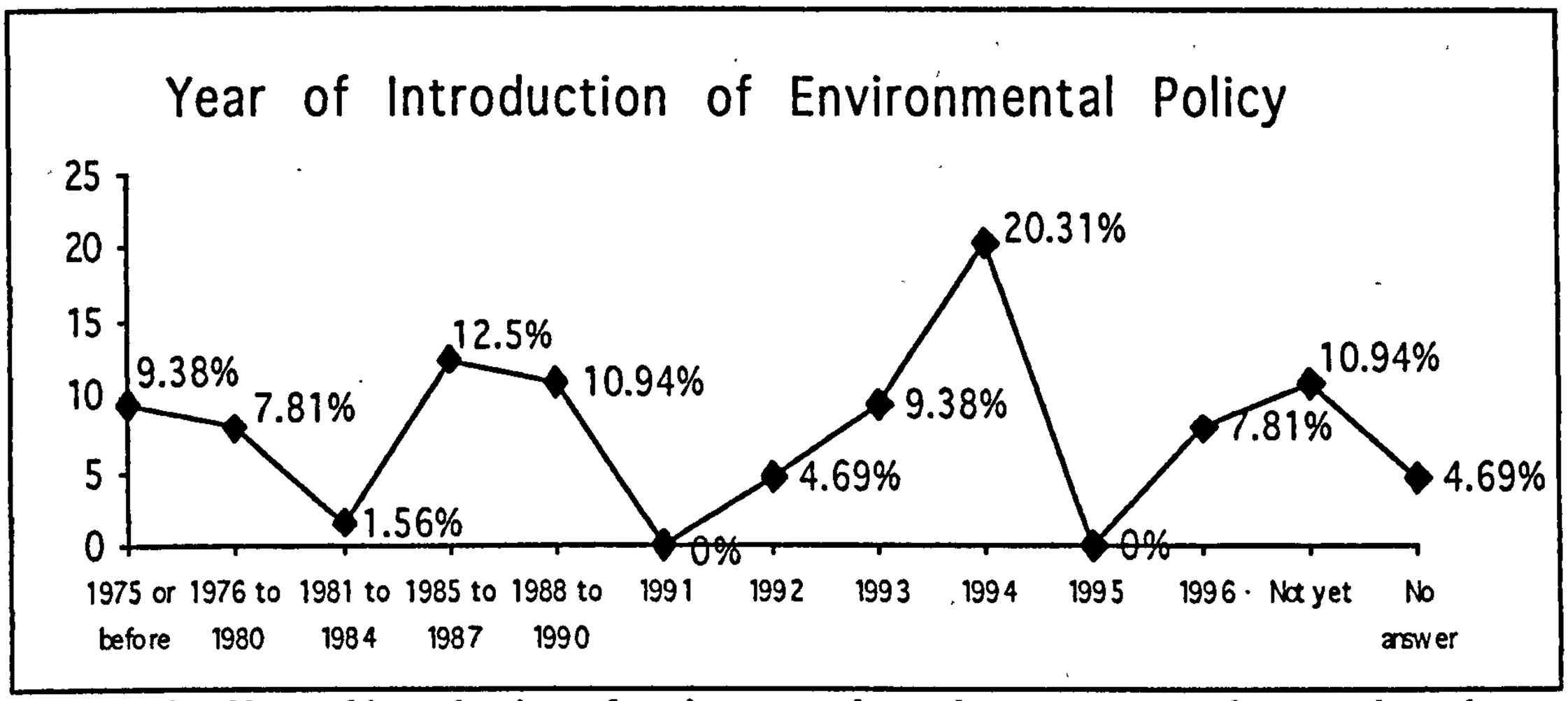

Figure 6.5 ***Year of introduction of environmental requirements on products and services by packaging business***

In the item which asked when companies introduced environmental requirements on products and services the answers have big variations. The biggest percentage indicated in 1994 (thirteen respondents equivalent to 20.31%), and a 9.34 percent indicated 1975 or before (six respondents), while 10.94 percent (seven respondents) stated 'not yet'. The complete picture of the answers illustrated on the figure 6.6 above.

Moreover subjects have been asked to indicate the proportion of environmental information that they had accommodate from a list of sources provided. Most respondents indicated as the most important source of environmental information for business activities were the journals and publications, scored with a 51.63% (thirty-three respondents) while as second sources (*75% of the time* - ranking with 2) but not with very high score are exhibition (15.63% coming from the number of eighteen respondents) and client requirements (15.63% percentage of ten respondents). In addition, college studies is the highly rated score for not providing environmental information 40.63 percent (twenty six respondents) stated 'hardly ever' (ranking 5) and 28.13 percent (eighteen respondents) *'never'* (ranking 6). This is of interest if compared with the age group of the respondents, most of them were 30 to 36 years old (secondly 37 to 46 years old) and they indicated that they have a first degree.

Below are the key findings ordered in the following way:

- percentage of respondents who always (ranking 1) learn information about environmental implications for business activities from the source indicated.

- most popular ranking preference for the particular source of information.
- percentage of respondents who never (ranking 6) learn information about environmental implications for business activities from the source indicated.

	Most important source	Most popular ranking answer	Least important source (rank to)
College studies	(1.56%)	5 (40.63%)	(28.13%)
Conference	(1.56%)	3 (37.50%)	(18.75%)
Exhibition	(0.00%)	5 (29.69%)	(7.81%)
Journal/ publications	(10.94%)	2 (51.56%)	(0.00%)
Clients requirements	(9.38%)	3 (39.06%)	(6.25%)

Table 6.2 ***Sources of environmental information for paper packaging businesses***

'Other' included the comment: *"Practical learning at work"* Head of Environmental Affairs. The same comment was cited by five more respondents, all of them responsible to implement environmental issues within paper packaging products.

The last item in this section requested the respondents to explain what environmental practice in paper packaging business sector means for them. To help them a list of options was provided. Environmental legislation and standards is the most highly rated answer (37.50% - twenty four subjects).

Below are some comments in the relation to the open question, if the answer is positive in adopting environmental legislation and standards, which one is in place now in your company, answers were:

- *"Satisfying our customers requirements."* Sales Department, Packaging Design
- *"Lots of different environmental regulations."* Head of Environmental Affairs
- *"Packaging waste legislation being implemented"* Packaging Manager, Toys Packaging
- *"ISO 9002."* Manager
- *"Producer Responsibility Obligations (Packaging Waste) Regulations 1997."* Packaging Engineer
- *"14001"* Manager, Packaging Manufacturer
- *"Paper recycling."* Research Manager
- *"Packaging Waste Directive."* Packaging Engineer, Paper Packaging
- *"Priorities in our customers requirements."* Packaging Design Innovation
- *"Recycling legislation."* Manager, Packaging Manufacturer

It is obvious from the above answers that packaging businesses are concerned about packaging and packaging waste legislation, which has direct effects on packaging design as well as in terms, for example, of reducing the amount of materials used in packaging and using recycled materials where possible. But the respondents also indicated concerns on

environmental management systems that it might imply an understanding of controlling their business activities at corporate level or it can indicate that an environmental certificate is good in support of their corporate image.

The answers given in the above item are described in more details in the table 6.3 below. The key findings ordered in the following way:

- the first preference percentage of respondents regarding environmental practice options
- the most popular stated preference for each option listed.

	Most important preference	**Most popular ranking preference**
Adopting environmental legislations and standards	(37.50%)	2 (59.67%)
Support community environmental relation programmes	(12.50%)	2 (59.38%)
Encourage customers to consider in depth the environmental implication of your business activities	(28.13%)	2 (50.00%)
Integrate environmental management in corporate level	(51.56%)	2 (37.50%)
Recognise environmental risks as part of the normal checklist of risk assessment and management	(48.44%)	2 (51.56%)
Checking your suppliers approach to environmental standards/official certificate	(29.69%)	2 (53.13%)
Giving environmental information to consumers in an ethical context	(35.94%)	2 (43.75%)

Table 6.3 ***Environmental practice indicators in paper packaging business***

'Other' included a number of comments related with environmental legislation and standards:

- *"Governments take back legislation and zero packaging goal within the next couple of years is possible if enough people do something about it. Germany is a reasonable success at least as a start. We simply must start somewhere and work from there."* Environmental Researcher. Consultancy
- *"Reducing your environmental impact."* Environmental Consultancy

The complete analysis of section 1. is presented in table V. 2 in Appendix V.

Section 2 - Corporate Environmental Profile

The first item in this section required the respondents to specify when their organisation started its initiatives to be environmentally aware. A list of options were provided. The biggest number of subjects fifteen (23.44%) stated the 1994 as the year that their organisation started environmental activities and twelve (18.75%) said in 1975 or before. All the answers are pictured in figure 6.6.

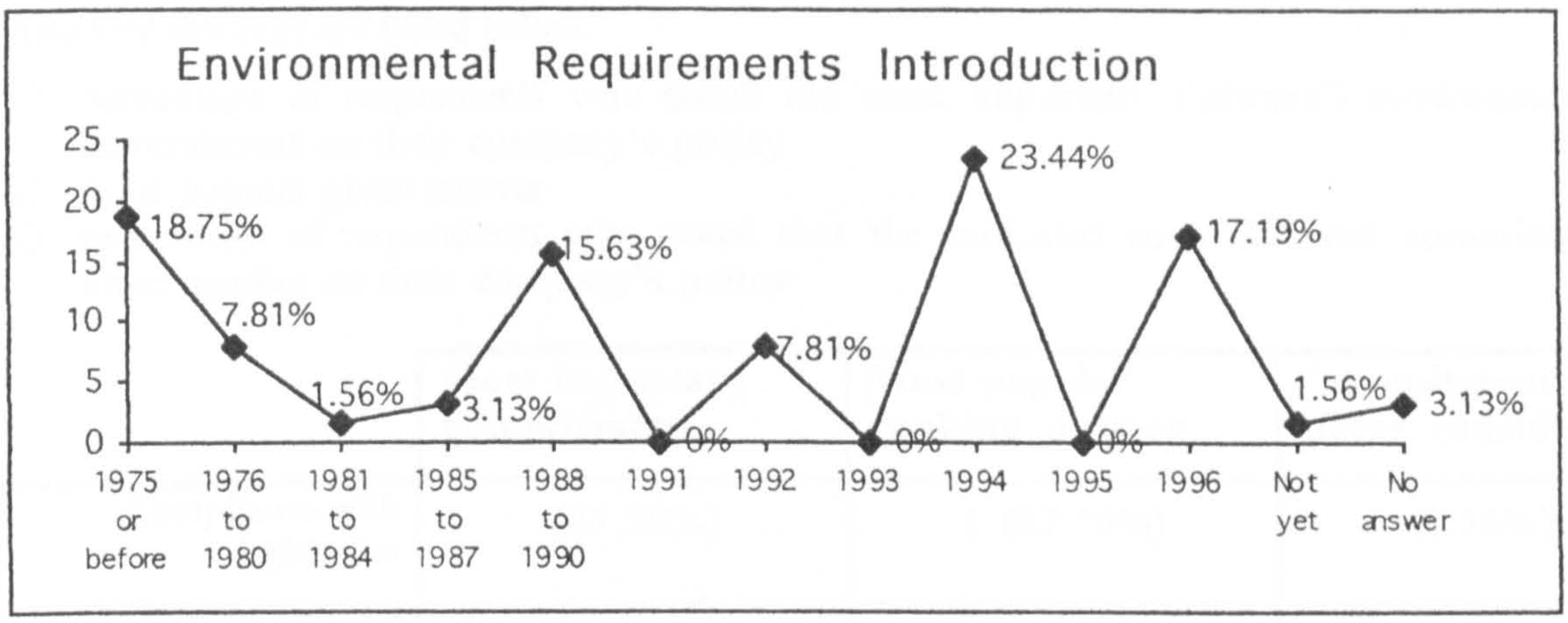

Figure 6.6 ***The year that the respondents organisation start its environmental responsibilities***

Moreover the majority of the subjects said that their organisation have an environmental policy with twenty nine stated *always* and twenty said *nearly always*. The following chart (figure 6.7) gives the complete picture in response to the item.

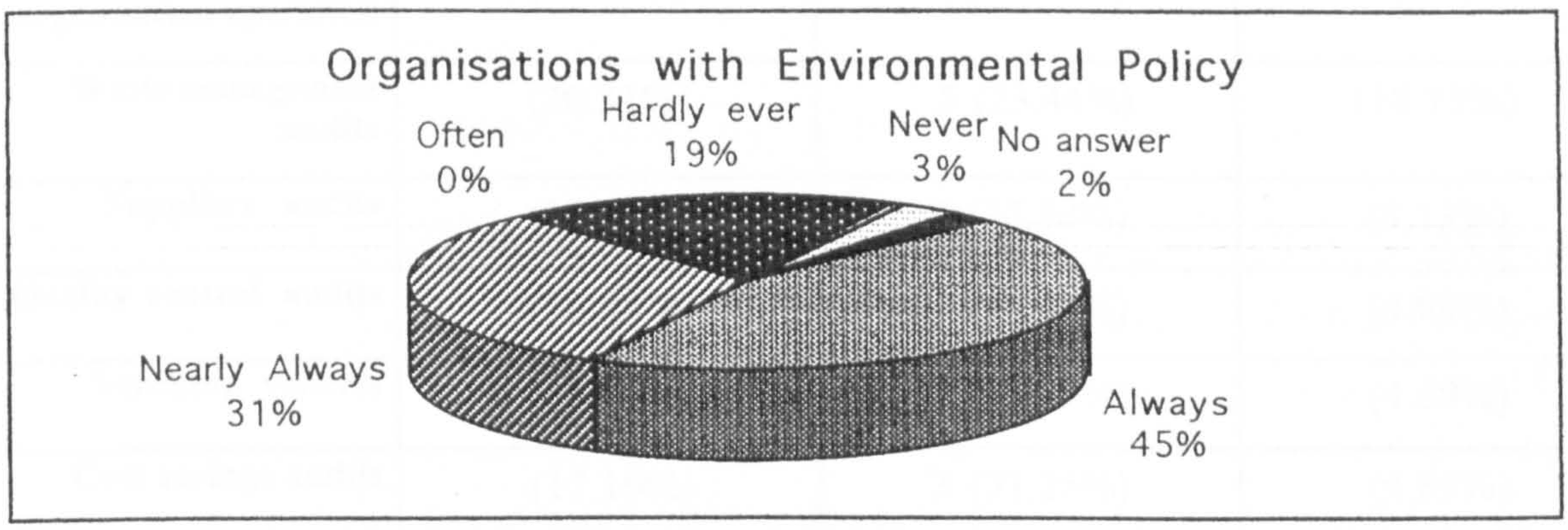

Figure 6.7 ***Percentage of respondents whose organisation has an environmental policy***

In the follow up question: when was the policy formally established the answers were:

- ☐ More than four years ago (51.56%) - *the higher score* with thirty three subjects.
- ☐ Three years ago (18.75%) - twelve subjects.
- ☐ Last year (1996) (17.19%) - eleven subjects.
- ☐ This year (1997) (1.56%) - one subject.
- ☐ No answer (10.94%) - seven subjects.

The following item asked the respondents to describe what sort of environmental commitments the policy of their businesses implies. A list of options was given and scale of commitment described starting with *'always'* (that coded as value '1') to 'never' (coded as value '6'). The answer that scored the highest percentage (87.50% - fifty six subjects) are commitments regarding compliance with legislation, followed by control of environmental impact of business operation (46.88% - thirty subjects).

The key findings are listed below.

- percentage of respondents who stated the most important ('always') environmental commitment on their company's policy
- most popular given answer
- percentage of respondents who stated that the indicated environmental commitment never applies on their company's policy

	Most important commitment	**Most popular ranking answer**	**Commitment that never considered**
Compliance with legislation	(87.50%)	1 (87.50%)	(1.56%)
Control environmental impact	(46.88%)	1 (46.88%)	(1.56%)
Specific management aspect related with corporate policy systems	(25.00%)	2 (34.38%)	(18.75%)
Particular area of organisation operation	(28.13%)	1 (28.13%)	(0%)
Waste management audits	(20.31%)	5 (23.44%)	(18.75%)
Suppliers audits	(37.50%)	1 (37.50%)	(3.13%)
Quality control audits	(26.56%)	1 (26.56%)	(4.69%)
Verifying systems	(18.75%)	3 (31.25%)	(4.69%)
Cost savings audits	(17.19%)	3 (31.25%)	(4.69%)

Table 6.4 ***Environmental commitments that considers in paper packaging business environmental policy***

'Other' comment offered was: *"Safe handling and application of products. Disposal of empty containers."* Packaging Consultancy.

The respondents were then asked if their organisation had changed its environmental policy over the last decade. The answers have some variation, while a considerable number of

twenty four subjects (37.50% said '*Yes*') were positive about the same number (twenty two) were not sure (34.38%) and eighteen subjects (28%) were negative.

Furthermore respondents who replied positively were asked to recall when was the change in policy and also to explain what was the principal catalyst for the change of policy. Their answers are described as follows:

Stated year for change of policy	**Reason for the change of policy**	**Job Description Business Activity**
'1991'	*'Merger'*	Head of Environmental Affairs
'6 years ago' *(1991) The year of the survey conducted is 1997.*	*'Moved the mamufacturer operation.'*	Business Manager, President, Packaging Manufacturer Company
' four years ago' *(1993) The year of the survey conducted is 1997*	*'Improved the manufacturing operation'*	Business Manager, Packaging Manufacturer
1994	*'To focus on Sustainable Business Development. Better understanding of how future environmental pressures would affect business'*	Fine Papers Environmental Advisor
'1996'	*'Waste legislation.'*	Packaging Manufacturer
'1996'	*'New legislation and technology.'*	Manager, Packaging Manufacturer
'1996'	*'ISO 14001.'*	Packaging Construction
In addition, stated *'A progress of continuous improvement over the ten years period.'* No year specified.	*'Pending legislation in many countries.'*	Packaging Consultancy

Table 6.5 ***Respondents stated reasons and year of changing environmental policy in packaging business***

The introductory item about environmental auditing activities, asked respondents to indicate from a specified list provided which terminology described best for them the term *'environmental audit'*. Most agreed descriptive option (34.38% - twenty two subjects) for the environmental audit as: *'a business commitment to safeguard compliance with environmental legislation and standards'*, In the second choice ('tend to agree'- *ranking with 2*) a number of definitions highly scored, as illustrated in the list below.

Below are the key findings:

- percentage of respondents who 'agreed strongly'
- most popular ranking value - from 'agree strongly' value 1 to 'disagree strongly' that valued as 4.

	Most important tendency to agree	Most popular ranking preference
A management tool to control business environmental activities	(25.00%)	2 (54.69%)
An environmental process in corporate level	(20.31%)	2 (43.75%)
A business commitment to safeguard compliance with environmental legislation & standards	(34.38%)	2 (54.69%)
A way to talk and present companys' environmental performance	(3.13%)	2 (53.13%)
A format to check business environmental impact	(28.13%)	2 (37.50%)

Table 6.6 ***Descriptive definitions of the term 'environmental audit'***

No other definition were stated. A comment offered about the definition 'a format to check business environmental impact' is as follows: *"Agree strongly - A complete analysis of the environmental impact of all company consequences. i.e.: related to the products they sell."* Environmental Researcher, Consultancy.

However most of the subjects stated that their company does not hold environmental audits which address the impact of its whole operation with great frequency. Twenty subjects said '*hardly ever*' (31%), while only twelve (19 percent) said '*always*'. Figure 6.8 presents all the findings of the above question.

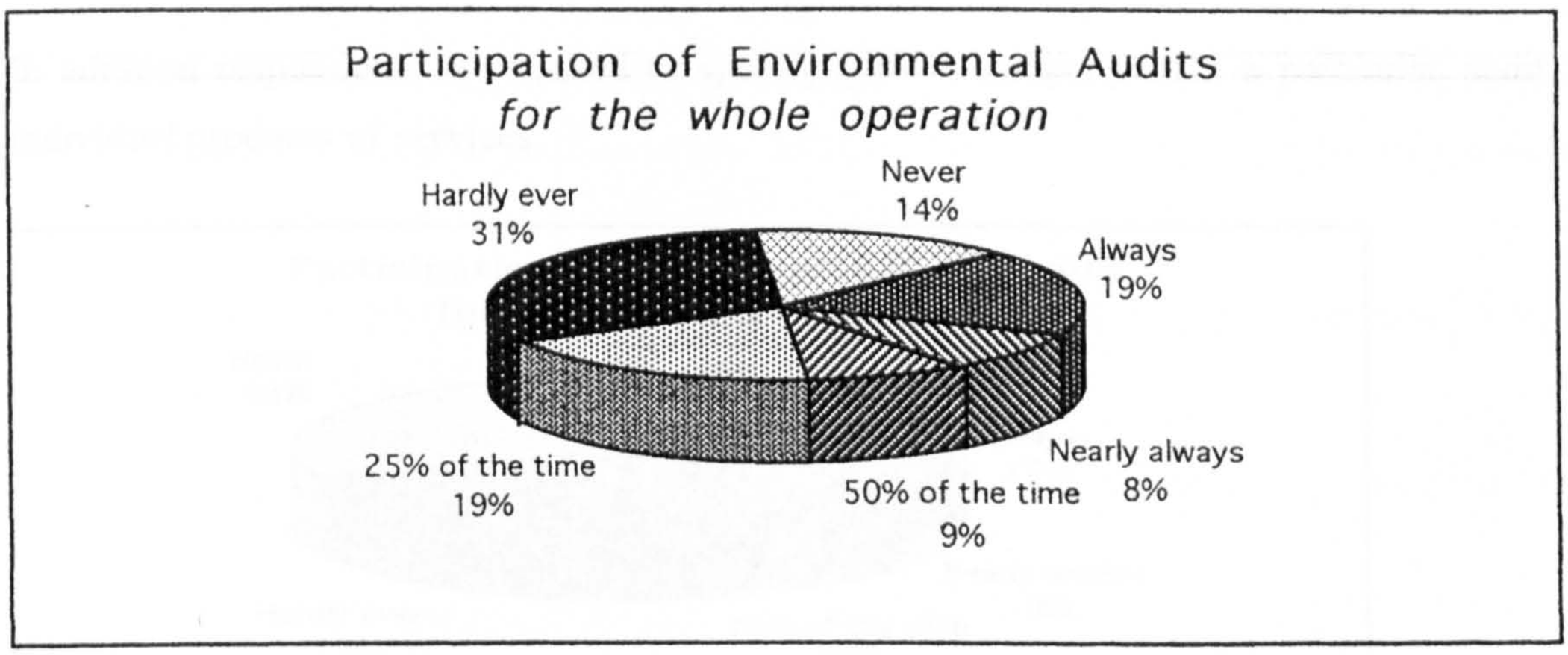

Figure 6.8 ***Percentages of 'environmental audits' that addressed the whole impact of packaging business operation***

The follow up item asked the respondents to describe the frequency of environmental auditing activities held by their companies. The findings given in the figure 6.9 below.

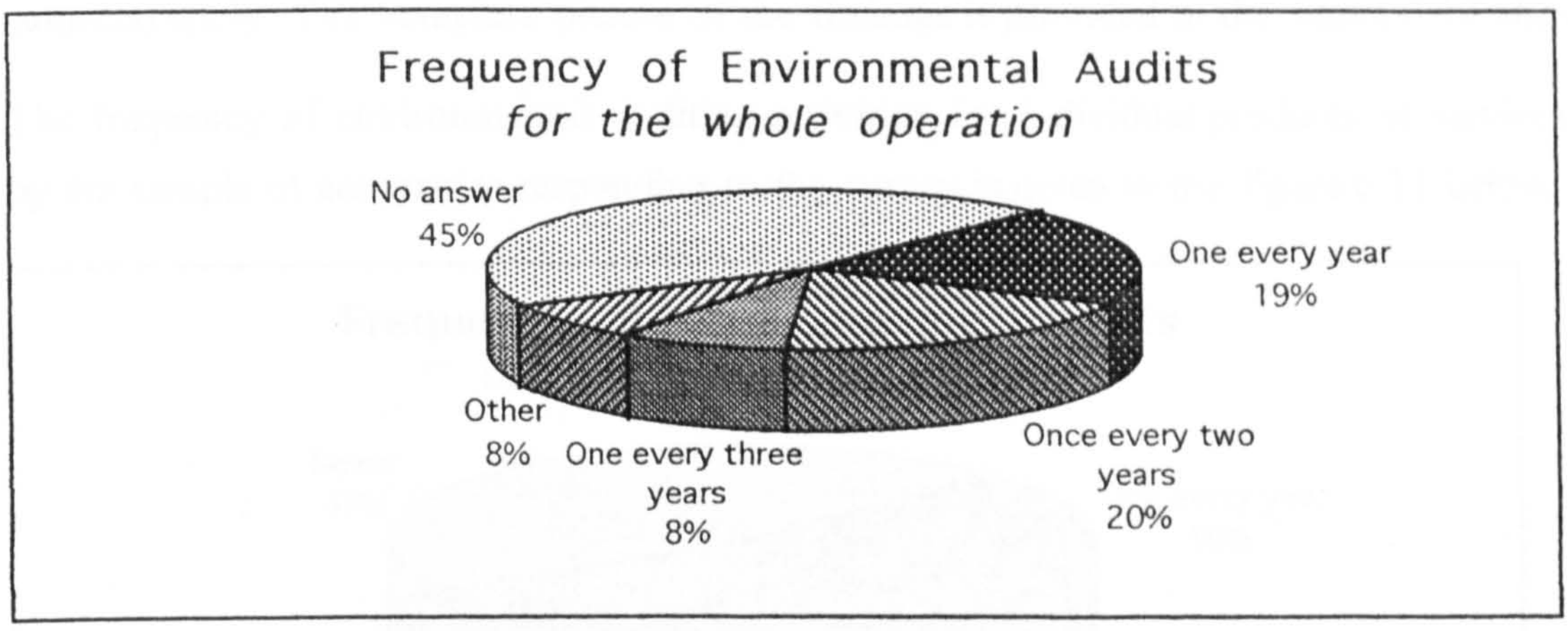

Figure 6.9 ***Frequency of 'environmental audit' activities that address the whole impact of packaging business operation***

'Other' included a number of comments as follows:

- *"Three times/year"* Paper Mill Company.
- *"Depends on the legislation"* Chief Designer, Packaging Manufacturer.
- *"One every three years. Periodically in some aspects of operations. Never on an overall basis."* Business Manager, Packaging Manufacturer Company.
- *"Info not available."* Packaging Engineer.
- *"Depends on the legislation/ periodically."* stated by Fine Papers Environmental Advisor; Paper Company; Paper Environmental Advisor; Paper Company.
- *"Audit frequency depends on the legislation"* Chief Designer, Packaging; Packaging Designer, Packaging Manufacturer; Design Manager, Paper Packaging Manufacturer; Paper Packaging Manufacturer.
- *"Periodically depends on the legislation."* Manufacturer Packaging.
- *"Not enough information available."* Packaging Designer, Toy Manufacturer; Packaging Engineer; Paper Packaging Manufacturer; Designer, Paper Packaging Manufacturer.

In addition respondents were asked to specify *if their* company held a particular audit for individual products or services.

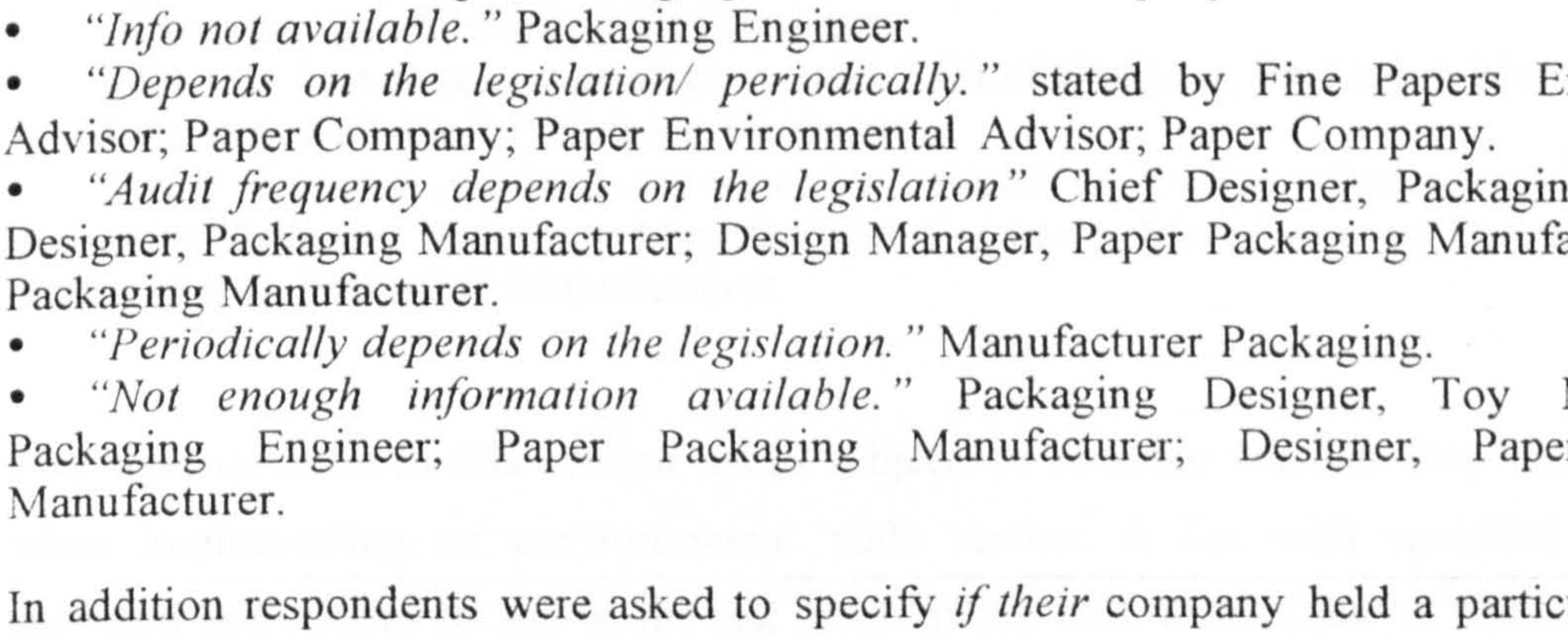

Figure 6.10 ***Percentages of audits that addressed the environmental impact of products and services in packaging business sector***

The highest score of respondents is again close to 'hardly ever' (18.75% - twelve subjects) and 'never' (43.75% - twenty eight subjects), for 'always' a percentage of 15.63% (ten subjects) apply. The complete picture of the findings is provided in the figure 6.10 above.

The frequency of environmental auditing activities for individual products or services held by the sample of companies responding to the survey is given in the figure 6.11 below.

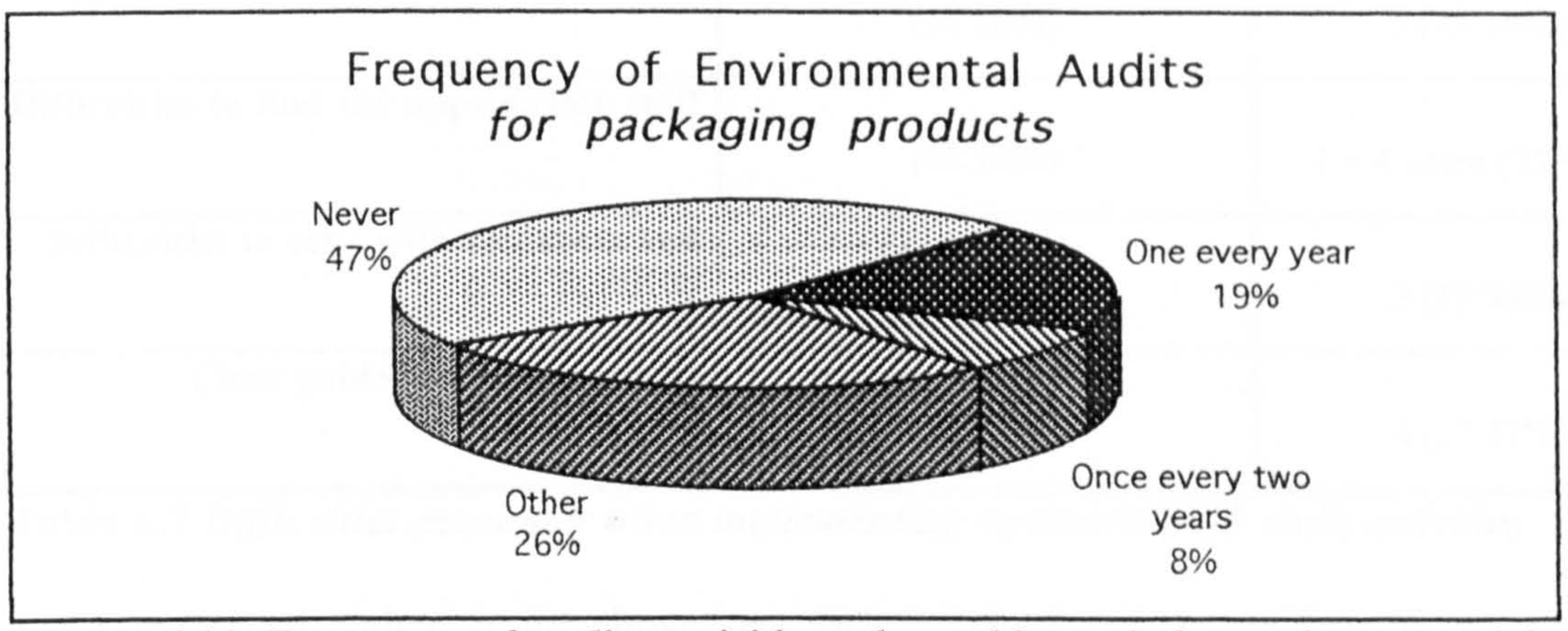

Figure 6.11 ***Frequency of audits activities that addressed the environmental impact of products and services in packaging business sector***

The selection of 'Other' in the above item included a number of comments as follows:

- *"Three times/year"* Paper Mill Company
- *"When we launch a new product, system."* Chief Designer, Packaging Manufacturer
- "Info not available." Packaging Engineer
- *"Apply for new product introduction."* Head of Design, Packaging Manufacturer; Packaging Designer, Packaging Manufacturer; President, Manufacturing Packaging; Head of Design, Paper Packaging Manufacturer.

The final question in this section asked subjects to indicate whether they have difficulties when implementing an environmental audit review. A list with specified answers was provided and options to add to the list given at the end. Difficulties to collect appropriate data when implementing an environmental audit review was the most popular answer scored with 45.31 percent (twenty-nine subjects) for 'always'.

Bellow are the key findings ordered in the following way: percentage of respondents who thought the selected motivation was the most important

- the percentage of respondents who applies in the option 'always' (valued with 1) in every difficulty specified in the list.
- most popular ranking answer for the particular difficulty

	Most important difficulty encounter in implementing environmental audits activities	Most popular ranking answer
Difficulties to collect data	(45.31%)	1 (45.31%)
Difficulties to control the whole process	(34.38%)	3 (35.94%)
Difficulties to find the appropriate staff	(17.19%)	3 + 4 score (25.00%)
Difficulties to cope with resources and costs involved	(34.38%)	3 (35.94%)
Clear guidelines not available	(17.19%)	4 (32.81%)

Table 6.7 ***Difficulties encounter when implementing environmental audit activities***

The selection of 'Other' in the above item included the following comments:

- *"No real experience."* Packaging Manufacturer Company
- *"No clear EI* (Environmental Impact) *comparisons for industry. We need a large order of magnitude more in research to assess what the EI of the actions and products we buy are."* Environmental Researcher

Section 3 - Environmental Management approach

The first item in this section asked the respondents to specify how their companies carry out their environmental activities. For this purpose a specified list with different value answers was provided. The ranking rate started from *'very likely'* equalling '1' to *'very unlikely'* equalling '4'. Most of the subjects 37.50 percent (twenty-four respondents) stated that they collaborate with independent governmental bodies/ verifiers (that applies in the use of EMSs) and a 35.94 percent (twenty-three respondents) indicated that they had an environmental management team in place.

For a better description of the key findings the list below provides information ordered in the following way:

- percentage of respondents who '*very likely*' carry in the way indicated on the left row their environmental activities.
- most popular ranking preference for the particular way that companies carry out their environmental activities
- percentage of respondents who *very unlikely*' carry in the way indicated on the right row their environmental activities.

	Very Likely	Most popular ranking answer	Very unlikely
We employ an external environmental consultant	(10.94%)	4 (40.63%)	(40.63%)
We have an environmental team in place	(35.94%)	4 (35.94%)	(35.94%)
We collaborate with external environmental auditors	(26.56%)	2 (40.63%)	(12.50%)
We collaborate with independent governmental bodies/verifiers	(37.50%)	2 (43.75%)	(18.75%)

Table 6.8 ***Human resources involved in implementing environmental auditing activities***

The selection of 'Other' included the comment: *"We are just forming an environmental management team."* Business Manager, President, Packaging Manufacturer Company

In the item following respondents were asked to specify whether their company presented its environmental activities/performance. 17.19 percent (eleven) of the respondents said that *'always'* whether their company present its environmental activities/performance, 25 percent (sixteen) said *'hardly ever'* and 15.63 per cent (ten) said '*never'*. The findings of this question illustrated in the figure 6.12 bellow.

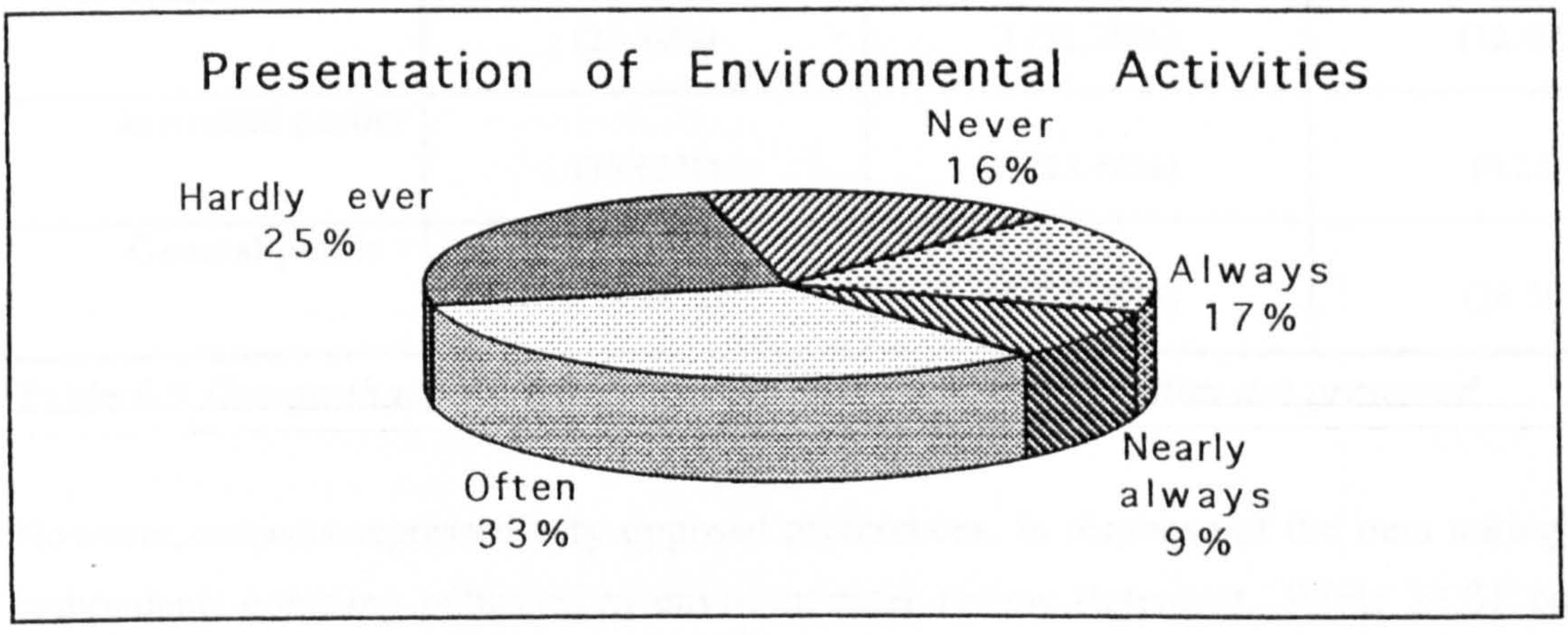

Figure 6.12 ***Percentage of paper based packaging companies that present their environmental activities***

The follow up item asked the respondents to specify when their company is presenting its environmental performance in what 'groups' the environmental performance was presented. The groups provided in a specified list. The most popular group that companies presented their environmental performance is the 'board of directors' with a 59.38 per cent (thirty-eight subjects) said 'always', followed by 40.63 per cent (twenty-six) indicated the

'stakeholders' group, while the 'general public' took the biggest percentage (26.56% equivalent to seventeen subjects) of not presenting businesses environmental activities.

The list below provides the key findings ordered in the following way:

- percentage of respondents who '*always*' present their environmental activities in the 'group' indicated
- most popular ranking preference for the particular 'group'. The ranking are for '*always*'- 1; for '*75% of the time*' - 2; for '50% of the time' - 3; for '25% of the time' - 4; for *'hardly ever'* - 5; and, for *'never'* - 6.
- percentage of respondents who '*never*'' present their environmental activities in the 'group' indicated

	Environmental Information presented always	**Most popular ranking answer**	**Environmental Information never presented**
Stakeholders	(40.63%)	1 (40.63%)	(1.55%)
Board of Directors	(59.38%)	1 (59.38%)	(1.55%)
Employees	(34.38%)	1 (34.38%)	(1.55%)
Governmental Bodies	(23.44%)	3 (31.25%)	(12.49%)
Interested parties	(15.63%)	5 (23.44%)	(6.25%)
General public	(21.88%)	6 (26.56%)	(26.56%)

Table 6.9 ***Groups that packaging business environmental activities are presented***

However, subjects expressed very opposed preferences, in response of the item asking if the respondents company published an environmental review statement. While 32.81 per cent (twenty-one) of the respondent said always, in opposition a 40.63 percent (twenty-six) said never. A good description of the findings provided in figure 6.13.

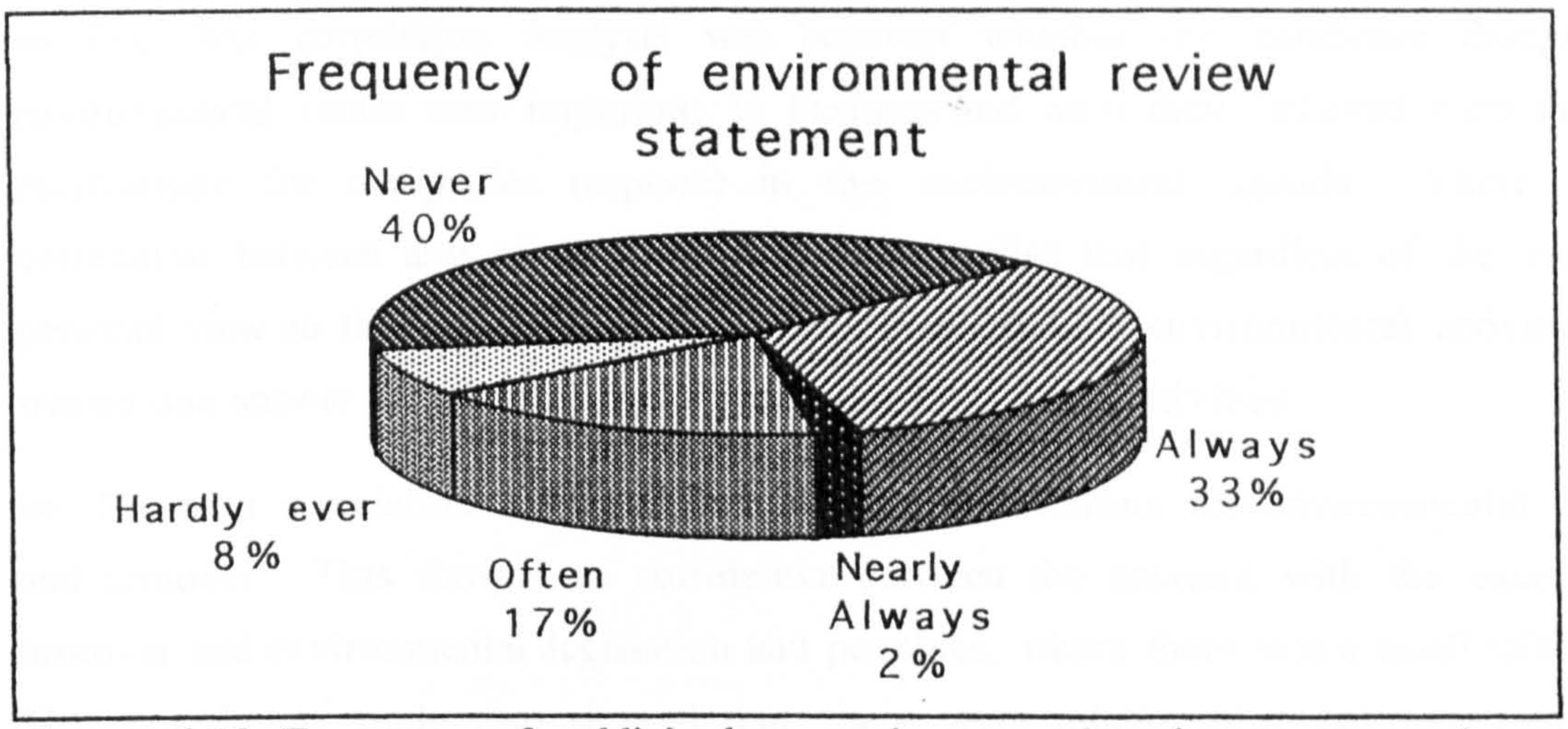

Figure 6.13 ***Frequency of publicised an environmental review statement by packaging business***

The follow up item asked from the respondents to indicate the format of the presented information, most common answer was the environmental report (32.81% equivalent to twenty one subjects).

Below are the key findings ordered in the following way:

- percentage of respondents who '*always*' present their environmental activities in the format indicated on the left row
- most popular ranking preference
- percentage of non respondents

	Environmental Information presented always	Most popular ranking answer	Non-respondents
Environmental report	(32.81%)	1 (32.81%)	(56.25%)
Leaflet	(7.81%)	3 (28.13%)	(48.44%)
Fact sheet for individual products or particular activities	(0%)	2 (23.44%)	(43.75%)

Table 6.10 ***The format of presented environmental information in packaging business***

6.3.2 The results - correlation studies

It was be predicted that there will be relationships between various sets of data. The study examines the correlation between different sets of data with the aim to discover how strong the relationship is between the two sets. The correlation analysis does not guarantee that there is a direct relationship between one set of data and another, but does imply that there could be a relationship. The findings are as follows:

⇒ The first correlation analysis was between whether the candidate thought that environmental issues were important in business and what they believed were the main motivations for companies response in the environmental agenda. There was no correlation between any of the answers. This implies that regardless of the candidates personal view on the importance of companies undertaking environmental activities there was no one answer for why the companies carried out these activities.

⇒ The next correlation examined was between motivations for environmental response and turnover. This showed no correlation between the answers, with the exception of turnover and environmental legislation and penalties, where there was a small relationship. This correlation study also showed that there were relationships between motivations involving consumer pressure and codes of practice and the turnover of the companies, implying that these three factors combined affect a companies motivation to undertake environmental agendas.

⇒ There was no relationship between turnover and the year that environmental requirements were introduced

⇒ Correlation between where information about environmental implications was sourced showed that where information was obtained was completely random within the study.

⇒ When studying relationships between what environmental practice meant to the individual, there was correlation between the answer they gave regarding supporting community environmental relation programmes, checking suppliers approach to environmental practice and giving environmental information to consumers in an ethical way. This could mean that companies are again influenced by outside sources and are conscious of how the public and suppliers regard them.

⇒ Within section two it was shown that the turnover of an organisation had no relationship with when they had implemented their environmental policy.

⇒ The next correlation was between environmental commitments of policy. It showed a relationship with compliance with legislation and controlling environmental impact. There is also a relationship between controlling environmental impact and particular areas of the organisations operations. When testing the verifying of systems, there was shown high correlation to specific management aspects related to corporate policy systems, waste management audits, suppliers audits and quality control audits. In addition to this there was shown high correlations of cost savings audits to waste management, supplier, and quality control audits and verifying systems.

⇒ Following on from this it was shown that there was no relationship between how respondents viewed environmental audits with the exception of small positive relationship of the views of an environmental audit being an analysis process at corporate level and a business commitment to safeguard compliance with legislation.

⇒ There is no relationship between the turnover of an organisation and how frequently they conduct their environmental audits.

⇒ There is a strong positive relationship between whether a company holds audits for particular products and how often the audits take place. If the company holds an environmental audit, it tended to be one every year.

⇒ Within section three it was shown that there is no relationship between the number of employees working within an organisation and how they carry out their environmental activities.

The final correlation study showed a strong positive relationship between whether an organisation presents it's environmental activities and performance and whether they publish an environmental review statement. Neither of these factors are related to the turnover of the organisation.

6.4 Observations

Not many respondents added something of significant importance in the open-ended item indicated at the end of each list of questions. All the comments provided are very much related to or in support of the options given. That implies that the study has provided all the possible indications in the specified list of answers. Also it considers as a good response that all the specified listed items were completed - a big number of 'no answer' items does not apply to the survey, that shows that the questionnaire was easy to complete with straightforward items and with the similar context in every section.

Summarising the most important of the findings gives the following indicators:

⇒ Paper based packaging companies found environmental issues to be very important in business operation.

⇒ Environmental activities are not closely related to the size of company or the business activities.

⇒ Environmental legislation (in particular EU packaging and packaging waste Directive) is a matter of concern to companies regardless of size.

⇒ But environmental legislation and penalties are of more concern to big companies.

⇒ Also, big companies tend to express more interest in codes of practice (Environmental Management Systems) and consumer pressures than smaller size companies.

⇒ Most of the companies have an environmental policy and they are much more interested in complying with legislation.

⇒ The term environmental audit emerged as *'a management tool to control business environmental activities'* and as *'a business commitment to safeguard compliance with environmental legislation and standards'*.

⇒ Companies that support environmentally related programmes also are companies checking their suppliers environmental approach and providing environmental information to consumers.

⇒ If the organisation presents its environmental activities performance these tend to be published.

⇒ If companies comply with environmental legislation they tend to hold environmental audits.

⇒ Companies that are interested in being verified for their environmental activities indicated that they considered specific management aspects related to corporate policy systems; waste management audits; suppliers audits and quality control audits.

⇒ Also, companies use cost saving audits relating to waste management, supplier and quality control audits.

⇒ There is no indication that the size of the company influences how often an environmental audit is conducted.

⇒ Paper packaging companies tend not to hold frequent environmental audits for the whole company's operation, nor for particular products or services.

⇒ But those companies that hold environmental audits for paper packaging products tend to have one every year.

⇒ The biggest difficulty in implementing an environmental audit review is to collect the appropriate data, followed by difficulties controlling the whole progress and difficulties to cope with the resources and cost involved.

⇒ When companies present their environmental performance it tends to be most of time to the board of directors followed by the stakeholders group and the employees. Less often companies present their environmental performance to the general public.

6.5 Summary

This chapter examined the formulation of the survey 'Environ Info System'. The chapter presented and analysed the findings of the survey obtained from UK based paper packaging businesses. It revealed current environmental practices in relation to the company's operation and with effects in the final product, also ways of conducting environmental analysis and reporting environmental achievements.

The next chapter is dealing with the formulation of the final model. In particular it presents specific interviews with experts in the field contacted to get the final feedback to test, refine and modify the final model presented.

CHAPTER 7. THE FINAL MODEL *The Environmental Management Control System - EMCS model*

7.1 Introduction

The final recommended solution of this research study is the *'Environmental Management Control System'* EMCS *model* presented in this chapter, and sub-models that illustrate the factors to be included for applying environmental management systems on paper packaging products. Based on the findings from the *Investigation* stage this chapter gives form to the *Testing and Evaluation* stage of the research. This stage includes the evolutionary prototyping and formative evaluation of the EMCS *model.* The EMCS *model* was tested and modified based on the findings from interviews with governmental/industrial bodies and packaging companies.

7.2 Evolutionary prototyping: Model Testing

At the *Testing and Evaluation stage* of the research the EMCS *model* assessed in two phases. Phase A. presents the evaluation of the revised format of the EMCS *model* that was initially presented in chapter 5. This evaluation was first to test the validity of the suggestions for improvements made at the *Investigation stage* and second to introduced and test possible modifications. The interviewees selected for this evaluation were *key informants* and all the different formats of model prototyping were bound together and presented to them. Based on their recommendations the EMCS model revised again and evaluated at Phase B. The format of the EMCS *model* that evaluated at Phase B. is very similar to the one presented in this thesis at a follow section.

The methodology used for prototyping the EMCS model follows the hard system approach stages defined by Waring (1989: 61) specifically the stage 8th *Implementation* stage which is the final stage aimed to put the solution (model) recommended from the 8th stage (*Making a choice*) into effect by evaluation with the end users. Based on the findings from this evaluation further system design work is required and this is implemented into the design of a new modified format of the model, that format tested again and modified to provide the final solution.

At this stage of the research the formulation of the model applies the thinking behind evolutionary prototyping which defined by Flynn as follows.

> Prototyping is often described as an evolutionary process. It is particular suited to being used in the evolutionary approach to systems development. In the evolutionary approach, a project is broken down into separate parts and each part

> in turn is taken through the development process. The emphasis is on a learning process, whereby users and developers refine the requirements or learn more about the possibilities of the technology, from the experience of developing and testing a given part and then use this knowledge to shape the development of the next part. [1]

The final format of the EMCS *model* follows an evolutionary prototyping process by providing a main model (see 7.3) for environmental analysis to be followed and sub-models (see 7.4) that are giving specifications and detailed explanations in support of the process of the main model. The sub-models are separated parts which contribute to the same end, thus they are the synthesis and operation of the main model. The main role of the sub-models is to allow the user to identify and develop requirements in support of their own companies specific needs. By following the steps provided in the sub-models the user gains knowledge, understanding and experience in the parts of the organisation operation that are under investigation. Following this, based on the experience obtained from the development and testing a given part, then this knowledge is applied to the development of the next part. Finally the findings and experience gained by the use of sub-models - *considered as parts of the system that the organisation operates* - allows the user to apply the findings in integrating the development of the whole process.

The advantages and disadvantages of evolutionary prototyping have been considered. According to ICSA (1193: 203) they are:

> (a) The task of project control becomes easier, as the tackling of individual parts is less complex than working on the whole.
> (b) It is not necessary to 'freeze' requirements for all parts at the outset.
> (c) Each part can be developed relatively quickly.
> (d) As with prototyping, users are able to see the effects of their decisions and the results of their requirements before the whole system is developed.[2]

The disadvantages to the evolutionary approach includes the following considerations.

> (a) A mistake in an early part may significant affect later work.
> (b) A project is likely to take longer from inception to completion than with traditional methods.
> (c) If risks phases are tackled early, the risk that changes may be necessitated by changing requirements will be increased.[3]

Advantages of evolutionary prototyping listed above have been applied to the models. To overcome the disadvantages the following steps have been taken.

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[1] Flynn: *Information systems requirements* extract from ICSA (1993) Study text. *Pre-Professional Managing Information System*, BPP Publishing Limited, London, p. 203 - 204
[2] Ibid.
[3] Ibid.

(a) The steps of environmental analysis described in each sub-model illustrate clearly the process to be followed so mistakes can be avoided. In addition the process is described in detail in an accompanying document.
(b) Efforts have been made to specified not the time that the businesses may required to use the process model but the period required to repeat the whole process. The aim is to maintain high level of improvement on environmental performance.
(c) The final disadvantage of the evolutionary approach is not applicable because each sub-model is independent and thus lowers the risk.

All the above considerations of the *evolutionary prototyping* approach are included in the formulation of the modified format of the EMCS *model* presented for evaluation at phase B. of model testing. The following section examines the formulation and the findings from phase A. of model testing. Those findings are then taken forward to phase B.

7.2.1 Method - EMCS model evaluation Phase A.

The first phase of model evaluation at the *Testing and Evaluation stage* deals with the options suggested for improvements to the EMCS *model* and the other four models introduced during the *Investigation Stage.* The method used is one-to-one evaluation with experts and key informants. The synthesis of the testing, the selection of the participants and the instruments used on interviews is described as follows.

Synthesis of testing

The interviews followed a pre-arranged structure according to an *interview schedule.* The potential respondent was contacted from a specified list (see below) with the request to offer a day and time to be interviewed. The *interview schedule* used an *attitude questionnaire* principally for evaluating the EMCS *model* but also facilitating free discussion close to the end of the interview of the other formats of model presented. The aim of the structured format of the interviews was to enable the researcher to analyse the collected information and anticipate any recommendations for improvements made and the changes required for developing the qualities of the EMCS *model.* The duration of the interview based on the evaluation questionnaire and materials for evaluation (copies of the models) used was about an hour and on some occasions this extended to an hour and a half or two hours including the free discussion.

Tested Participants

The participants selected from *The Institute of Packaging Directory and Review 96/97,* and *Technology partnership Guide to UK environmental technology and services,* participants under the heading of 'environmental consultancy service' and *'Eco Directory of*

Environmental Databases in the United Kingdom 1992. The criterion for selection of the participants was to be in a managerial level and have a substantial understanding of environmental management systems. It also considered the availability of participants during the period of this investigation. The professional activities of respondents companies included environmental consultancy, design consultancy and packaging retailer manufacturer. The selection of the key informants was on the basis of the recommendations made during the previous stages of the research.

Tested Instrument

The prospective interviewee received by post in advance the following material: covering letter that summarised the aims of the interview and reminder the day and time of the interview, a one page project description, and a page with the evaluation questionnaire. It was acknowledged the participants willingness to co-operate with the research, promised them that confidentiality will kept and that the information provided will be used for academic purposes. Moreover, it promised to let the participants be informed about the research outcomes if they wished.

The *evaluation questionnaire* used for models testing consists of nine items, from those four were grouped items, that means supported by a second or third item or provided suggested options for selection. The reason for that was to provide more specific recommendation in the same item. The questionnaire which follows aimed to investigate attitudes in relation to EMCS *model;* however the other formats of the models were evaluate during the free discussion in response to the final item of the questionnaire.

1) Are you familiar with the terminology used?
   1a) Does the terminology describe adequately the stages indicated?
   1b) Do you believe that the terminology should be borrowed from ISO 14000?
2) Is the EMCS model self explanatory from one stage to another?
   2a) Do you understand the directions and the links provided?
   2b) Please state if something is missing or not described adequately.
3) Do you think there is enough information and direction provided?
   3a) Do you believe that additional information to explain in details the process to be followed should included in the format of the model or should provided in a complimentary document?
4) Do you believe that the final synthesis of the EMCS model should appear in a more simplified format?
   4a) How do you perceive the idea of using a main simple model accompanied by sub-models that explain in more detail the stages of environmental analysis to be followed?
5) Please give your thoughts on the use of the sub-models for internal and external communication?
6) Do you find the EMCS model to have a practical application for packaging businesses?

7) Who do you believe could use the model?
8) Do you find any of the elements from the previous formats of the model prototyping to be useful for inclusion at the final format of the EMCS model?
9) Do you have any suggestions for inclusion on the final model?
9a) Do you have any comments on the research project?

Table VI.1 in appendix VI. presents the *Instrument used in Models Evaluation - 1st Phase.*

7.2.2 Results - EMCS model evaluation Phase A.

The format of the model under evaluation

The EMCS model was re-formatted based on the following recommendations made during the evaluation of the five prototype formats of the model at the *Investigation stage* Phase A.

⇒ Use a different template for auditing activities.
⇒ Attempt to use sub-models about auditing; internal and external communication level.
⇒ Provide additional directions about how to proceed in achieving environmental performance targets at internal and external level of companys' operation.
⇒ Simplify the links.

Furthermore, suggested modifications from the evaluation of the five prototype formats at the *investigation stage* that were not incorporated in the re-formatting form of the EMCS *model* are presented below. These suggested modifications are furhter examined during this evaluation in order to find the structure and the method to consolidate those amenities into the revised version of the model.

⇒ Reduce the amount of information to the minimum required to explain the point.
⇒ Explain better the format for the auditing activities.
⇒ Define the number of sub-models required to explain environmental management principles compatible with the packaging design process.
⇒ Examine the potentials of the MEPA model (in terms of structure and present information) to be part of the main model for defining eco-design activities.
⇒ Explore way to present the methods and requirements on how packaging companies can achieve environmental performance standards.
⇒ Investigate what more explanations can be provided about the impact of the use of strategic control to the environmental policy in the EMCS model (see figure 7.1).
⇒ Borrow terminology where available from the ISO 14001.
⇒ Simplify more the links and directions provided.

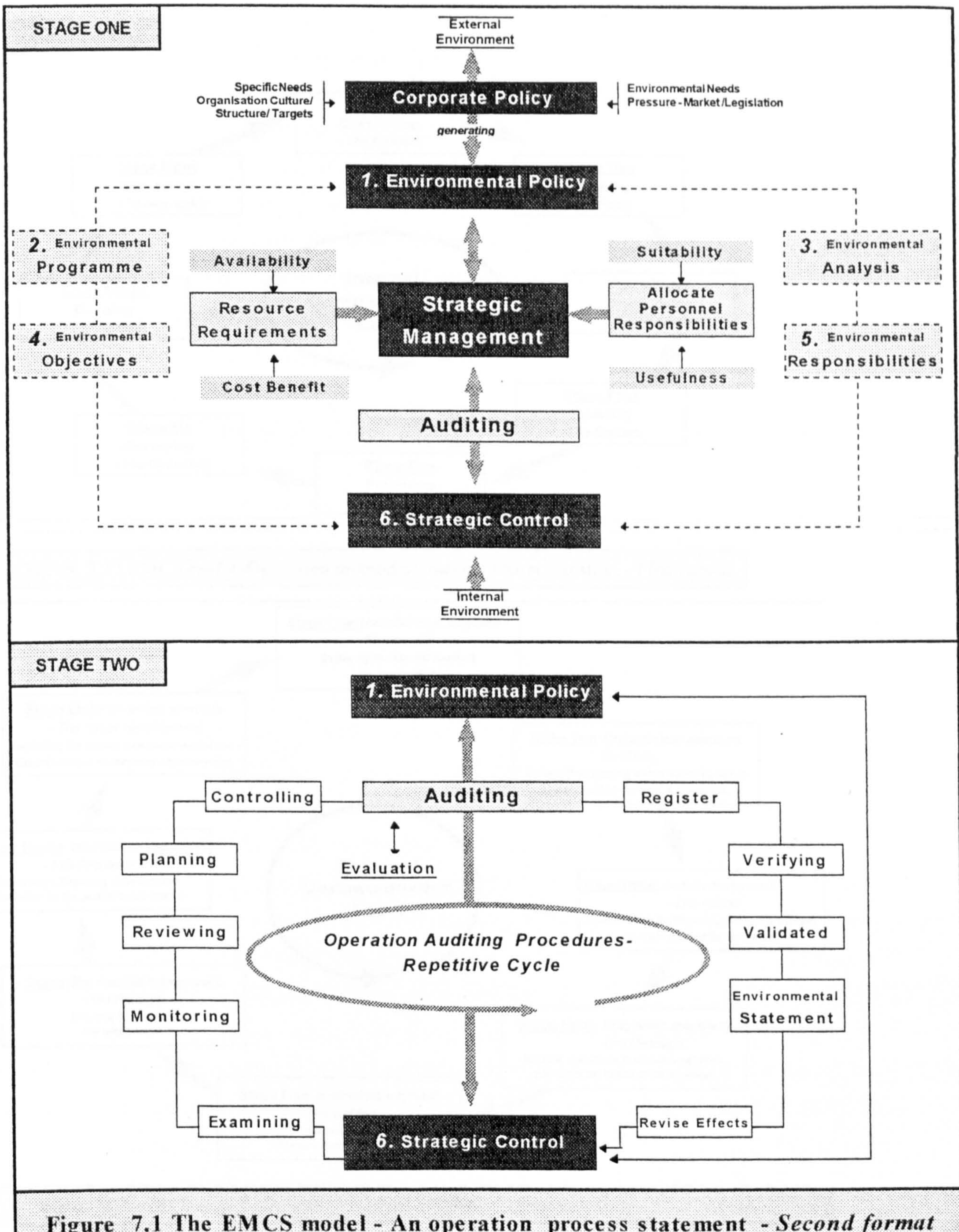

Figure 7.1 The EMCS model - An operation process statement - *Second format*

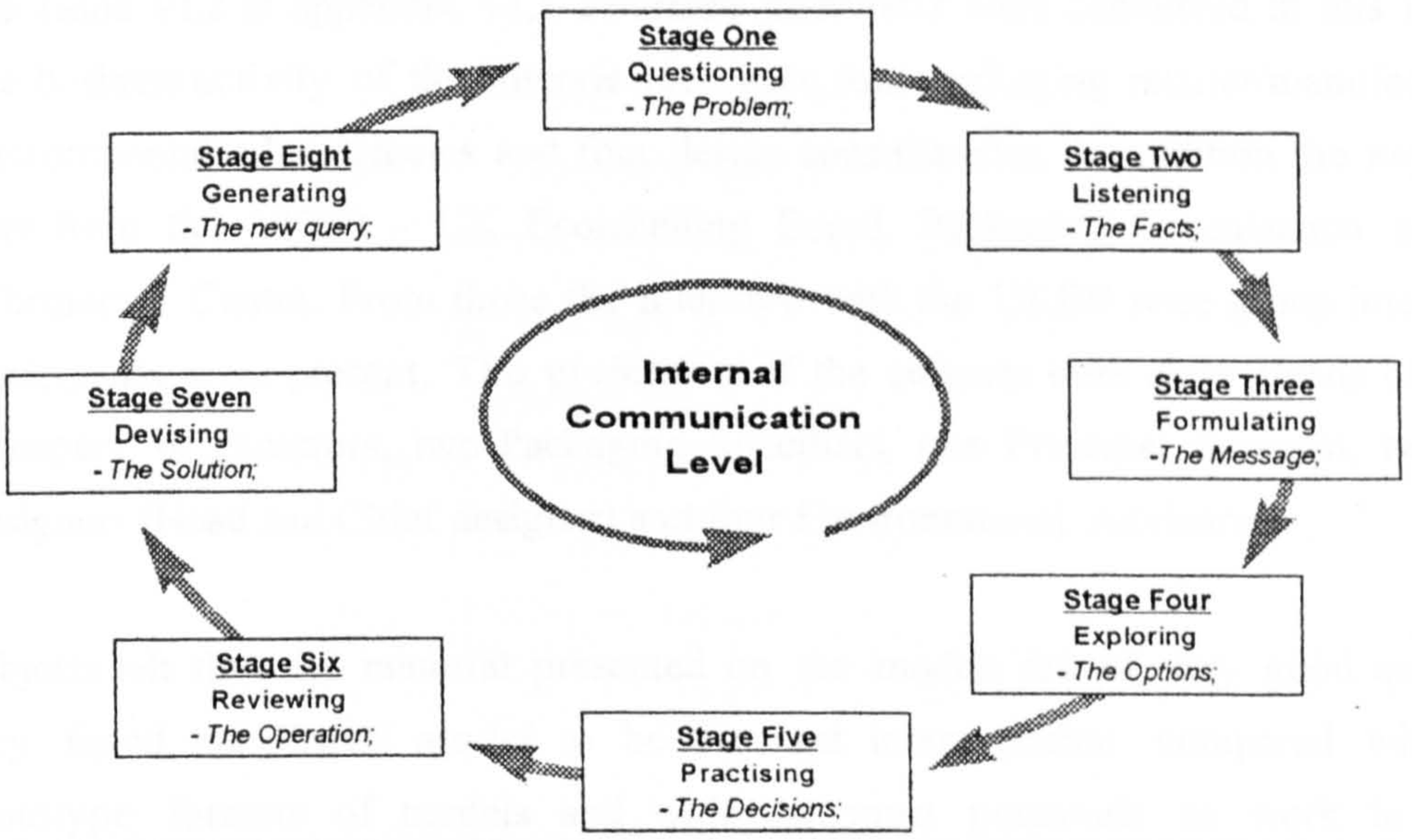

Figure 7.2 : EMCS *model* -Operation method of internal communication - *First format*

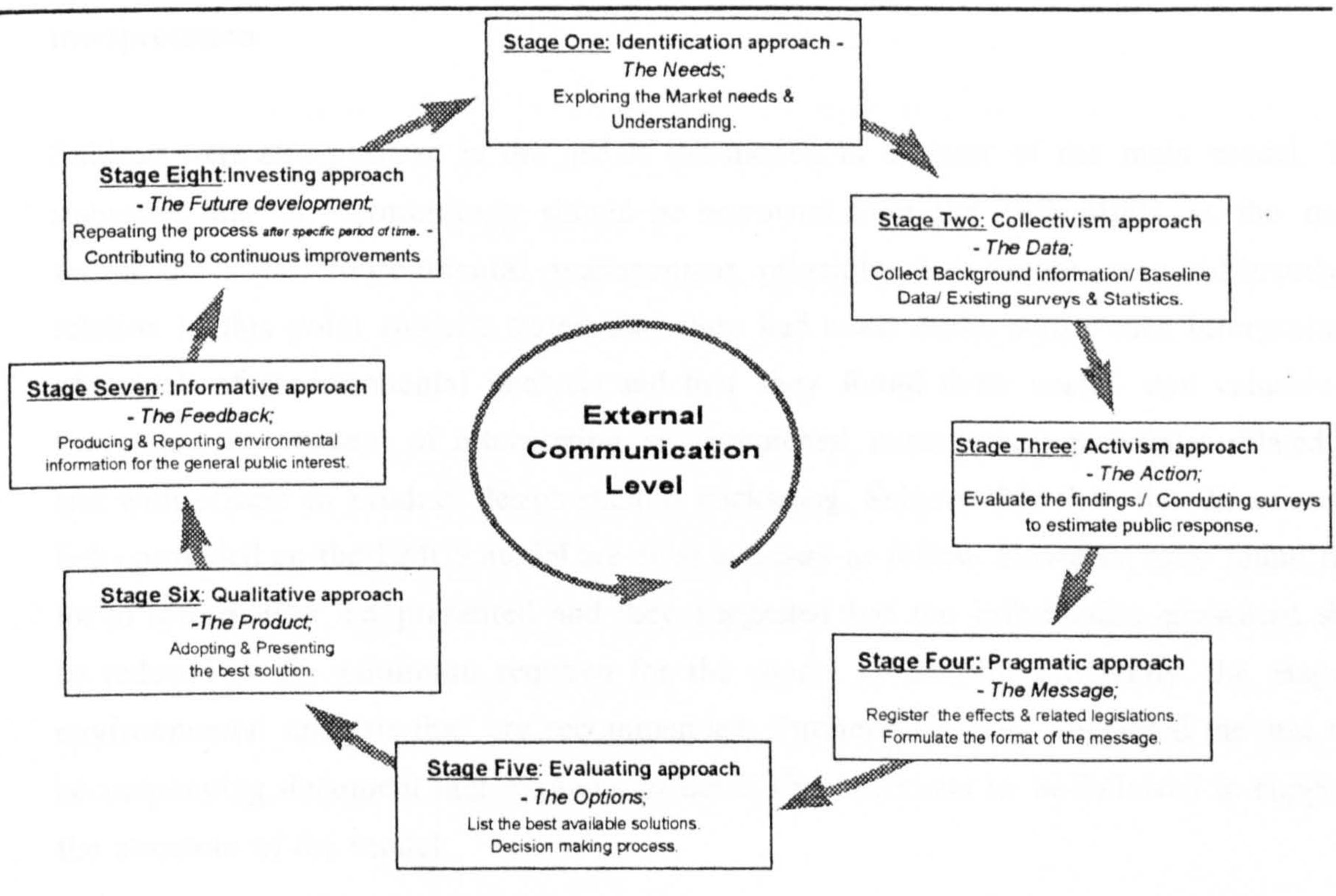

Figure 7.3 EMCS *model* - Operation method of external communication - *First format*

The findings from model evaluation

A content analysis was used to analyse the data obtained from the face-to-face interviews (see Table VI.2 in appendix VI.). Fourteen interviews were conducted in this investigation. The business activity of the interviewees were four packaging retailer/manufacturers, three environmental consultancies and four design consultancies. In addition the key informants were from the UKEB - UK Ecolabelling Board, Packaging Organisation and European Information Centre. From those the interview with the UKEB were group interview as two participants were present. The profession of the subjects were eight Heads of Production/ Managers, or Directors, two Packaging Specifiers, one Principal Scientist, two Packaging Designers (Head and Chief designer) and four Environmental Advisors.

Subjects felt that the material presented on the models are of very good quality. Besides they found the EMCS *model* to be the best interpretation compared with the other prototype formats of models and with the most potentials to work in practice. In particular, they found that the EMCS *model* provides clear directions, also the information included is useful and, the structure of the model, the links and the directions are of good interpretation.

Subjects were also positive in the use of sub-models in support of the main model. They suggested that the terminology should be borrowed from the ISO 14001 as the models follow the same environmental management principles but format very differently. In relation to this point subjects stated that they had never come across such interpretations of models of environmental analysis and that they found them useful and valuable and, very good the concept of interpreting environmental management principles related with and with effects to product design such as packaging. Subjects felt that the directions and links provided on the EMCS model are clear and easy to follow. However, they found that a lot of information was presented and they suggested that the information presented should be reduced to the minimum required for the model to describe efficiently the stages of environmental analysis that are recommended. Furthermore they suggested the use of an accompanying document that explains in detail the directions to be followed in support of the structure of the model.

Recommendations for improvements in the format of the EMCS model were:

- replace the wording '*strategic* management' with '*environmental management system*' as the central component of the model and replace the wording 'audit' with 'environmental audit'

- subtract the directions for 'resource requirements' and 'allocated personnel responsibilities' as information about these activities is described in the sub-models of internal and external communication.
- about the auditing cycle it should be kept the indication that is a repetitive cycle, however the stages to be followed should be in more descriptive.
- about the sub-models of internal and external communication the stages to be follow are described well but the information in each box needed rephrasing aiming to be more direct. In particular it suggested for the sub-model of external communication to keep only the information presented in the first two lines.
- the sub-models should describe: the environmental auditing methodology; environmental responsibilities at internal and external level of business operation; and design activities related to the eco-design characteristics and design management process.
- the information about eco-design activities and requirements presented in MEPA model can be kept and the model should be reconstructed and presented in a similar form like the EMCS model.

The model was recommended for use by environmental managers, environmental auditors and design managers. In addition, subjects felt that the EMCS *model* can also be used by an accreditation body. On such occasions the use of the model can be extended to awarding credits for different levels of environmental concern. They also suggested the possibilities for environmental awarding on packaging products to those companies that used the model.

The option of using *'eco-points'* (suggested in chapter 4.5) for environmental awarding of packaging products was discussed with the participants. They felt that the use of an assessment matrix that examined environmental factors related with the design process; manufacturing process; social, legal and performance issues is an applicable extension of the EMCS model. Subjects also felt that in such case a checklist with questions that specified the design of packaging should be supplied. Finally subjects suggested the use of three case studies to demonstrate the potential use of the matrix.

Further observations

The Environment Council recommend that Design for Environment (DfE) - also called Ecological Design (Eco-Design) - in practice should consider life cycle thinking in terms of the life cycle impact of product at key stages, before, during, and after the

conceptualisation of product design.[4] At each stage of the packaging's life cycle, raw materials and energy enter the system whilst waste and spent energy exit to the environment (air, land and water). Initial considerations about packaging's life cycle start at the stage when the design brief is formulated, such considerations include the brief and requirements from the client related as well with the product to be packed. The first basic questions should include thinking about the use stage of packaging: *What are customer requirements from the packaging? what service the packaging will provide to the packaged product? What extra values the packaging can offer? The brand? The image? Can these be provided in a way which has less environmental impact?*

The thoughtful process for packaging design is represented in figure 7.4. The corporate design strategy reflects the image of the client (brand differentiation) and it is directly related to the packaging design strategy. When the design brief developed is at the early design stage environmental considerations regarding existing options should be included. The decisions made at that stage lead to creating strict specifications for packaging. Design decisions are likely to affect the whole life cycle of the packaging. Because of that, packaging specifications should include simplified LCA thinking which aim to minimise the negative environmental impact during production (manufacturing), packaging use, alternative uses and disposal.

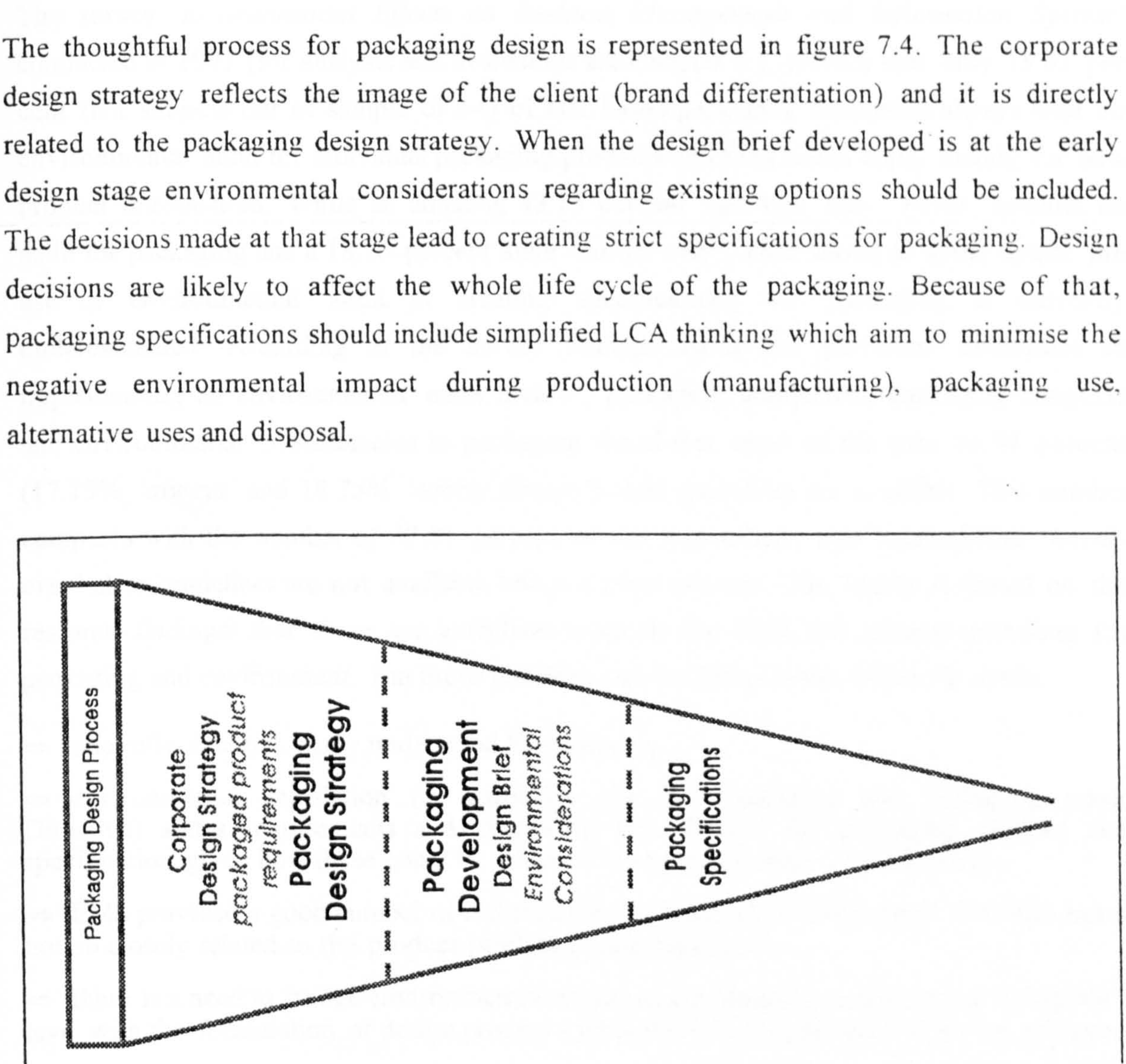

Figure 7.4 Narrowing the gap of Packaging Design Process

[4] The Environment Council (1997) 'A manager's introduction to product design and the environment', Business and the Environment Programme, UK, p 1

DfE (Eco-Design) reinforces improvement in environmental management through better inventory control and better process control at the design stage. DfE can reduce the environmental effects of a company's products and packaging, helping company to achieve environmental targets. DfE can contribute to systematic data gathering for suppliers and customers audit (The Environment Council, 1997).

The Environment Council (1997) sees the use of environmental audits as guidance for generation of design requirements in the product strategy *that 'highlight those parts of a company's operations with significant environmental impact'.*

The survey *'Environmental Effects on Business Management and Information System'* conducted in 1997 (for analysis and evaluation see Chapter 6.), reveals that only 15.63 per cent (ten subjects out of sample of 64) of UK based packaging businesses always hold an environmental audit for individual packaging products and such audits apply mainly for new product introduction. While an amazing 43.75 percent said that they *'never'* conduct an audit for packaging and a 18.75 percent state *'hardly ever'*. That shows to some extent the use of environmental audit in creating specifications for packaging is currently underestimated. According to the survey findings about the particular difficulties in implementing an environmental audit review[5], packaging companies, packaging designers and environmental consultancies in packaging found that most of the time 35.94 percent (17.19% *'always'* and 18.75% *'nearly always'*) clear guidelines are available. This number compares with the number of 32.81 percent of the respondents who believed that *'hardly ever'* clear guidelines are not available brings a contradiction. The reality is (based on the research findings) that there are guidelines available for EMS and general guidelines for packaging and environment. But these guidelines are suffering in the following terms:

⇒ scientific data not easily understood by designers;

⇒ environmental legislation (in particular the EC packaging and packaging waste Directive) states requirements and targets to be achieved for packaging without any specification given how these could be achieved in the design stage of packaging;

⇒ EMS provided a good number of information for business environmental activities but is not so closely related to the product (such as packaging) itself;

⇒ there is a need to bridge environmental management thinking orientated at company's level with the formulation of design process - what the Eco-Design and DfE try to achieve.

The respondents in the survey also indicated that they have *'always'* difficulties to collect the appropriate data (45.31%); also, a 70.32 per cent have difficulties to control the whole

[5] The question about which difficulties do you most encounter when implementing an environmental audit review; apply for individual packaging products, as well as a review that address the whole impact of packaging company's operation.

process (43.38% *'always'* and 35.94% *'often'*) and 70.32 per cent have difficulties to cope with resources and costs involved. These considerations are included in building up the model of environmental analysis particularly, in relation to the auditing sub-model so that the stages of environmental analysis to be followed to be more descriptive than the format of the auditing model presented in figure 7.1 (stage two). Specifically, while step-by-step directions on how to proceed in auditing activities are going to be provided in the revised format of the auditing model (see 7.6) and the terminology is going to use existing terms where applicable, the use of an accompanied document explaining in detail the auditing process is going to be written in a way that makes it possible to be understood by design managers and environmental managers.

The Environment Council (1997) recognise that: *'DfE is a logical extension of environmental management'* because it helps companies to achieve environmental policy objectives, and to implement principles of good environmental management. The Confederation of the European Paper Industries (CEPI, 1996) supports EMAS, and estimates that a significant number of pulp and paper mills across EU are interested to be certified with EMAS by the end of 1996.[6] Gash (1995) recommends for paper [including packaging paper products] companies that in order to participate in EMAS they must:

⇒ adopt environmental policies requiring legal compliance and commitments aimed at the continuous improvement of environmental performance;

⇒ establish an environmental management system, including preparation of an environmental effects register;

⇒ conduct periodic auditing of the environmental management systems and compliance with the environmental policies and of environmental management system; and

⇒ prepare public environmental statements noting significant environmental effects which must be checked and agreed to by an independent verifier.[7]

It has been brought up (based on the findings from the previous investigations) that to implement EMAS or Environmental Management Standards in packaging business it is essential to use environmental auditing procedures that examine and address the environmental impact of the whole company's operation. To achieve DfE and award on packaging products eco-design characteristics, it is necessary to conduct environmental audits for particular packaging products as part of the system as defined by the company's operation. The research paper *'Environmental Business Strategy: A new Model for Development?'* commented about environmental audit that it *'is an important tool in the*

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[6] CEPI (1996) personal communication, Confederation of European Paper Industries, Brussels, Belgium
[7] Gasch, M. 1995, 'EMAS and ISO: Will they be voluntary?', PIMA Magazine, November

managerial level of a company as it examines the environmental impact of company's operation in different stages, evaluates the best environmental option based on a standards set of criteria and according to existing legislation and companys' particular needs. Furthermore by conducting environmental analysis, eco-auditing makes environmental claims (on products) more meaningful.'[8]

Packaging businesses that responded to the survey '*Environmental Effects on Business Management and Information System*' were asked to describe what the term '*environmental audit*' means for them: all the indications provided in the specified list received a relatively high score and no additional descriptions were given. The results mean that most of the respondents 89.07 per cent (34.38% 'agree strongly' and 54.69% 'tend to agree') see the '*environmental audit*' as '*a business commitment to safeguard with environmental legislation and standards*'. 79.69 per cent (25% 'agree strongly' and 54.69% 'tend to agree') stated that '*environmental audit*' is '*a management tool to control business environmental activities*'. 65.63 percent (28.13% 'agree strongly' and 37.50% 'tend to agree') of the respondents described the '*environmental audit*' as '*a format to check business environmental impact*' while one of the respondents commented that this description closely related to the product and all company's environmental consequences. Finally 64.06% percent (20.31% 'agree strongly' and 43.75% 'tend to agree') stated that the '*environmental audit*' is '*an environmental process in corporate level*'.

As the above statements in describing the 'environmental audit' scored highly from the respondents of the survey, the study considered all these activities in presenting the operation of the environmental auditing. This study views the environmental audit as '*a management tool to control business environmental activities*'. Even if this was the second preference of the respondents (79.69%) it is the best way to describe an environmental audit for reasons as follow:

⇒ the 89.07 percent who believed that the '*environmental audit*' is '*a business commitment to safeguard with environmental legislation and standards*' is because packaging business are 'terrified' (see evaluation of the findings from the explanatory stage presented in 4.4) of their obligations that the EU Packaging and packaging waste Directive placed on them (formally adopted in 1996) and the specific targets for the UK packaging business given by the Producer Responsibility Industry Group; that is why that option scored

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[8] Sarri, E. And Holland, R *"Environmental Business Strategy: A new Model for Development?"* - 'Whose Values?' - Ethics in the International Business Environment, organised by Thames Valley University, March 18-20 1996. Park Court Hotel, Bayswater Road, London, UK

highly. In addition, the use of environmental audit in a management context should examine legislative compliance.

⇒ in addition, '*business environmental activities*' should include compliance with existing legislation and standards that affect their operation;

⇒ the use of environmental audit as a '*management tool*' to control business environmental activities could bring improvements in business overall environmental performance not just legislative, regulatory compliance. It can further enhance innovation in the business context as it not only deals with current environmental problems and activities but can predict future environmental trends and recommend improvements. This ability of environmental auditing should be closely related with packaging design for forward planning.

The findings from the survey and the findings from model evaluation at phase A. (see 7.2.2) are included in assembling the final structure of the *model* that leads the way to creating and optimising an environmental solution in the business context for paper packaging products.

Final Evaluation Implementation proposals

This study produced the 'Environmental Management Control System' EMCS *model* which is a combined approach to the use of EMS and eco-labelling - in terms of LCA considerations and assessment methodology. The EMCS *model* is formulated interrelate environmental management standards that apply at company level with environmental requirements and eco-design specifications at product (paper packaging) level. The EMCS *model* uses the terminology provided by ISO series on EMS. Definitions are borrowed from ISO for the development of the EMCS, mainly because ISO are the most recent standards on EMS and are international in spec. Also, because during the testing of EMCS on different formats the participants found confusing the use of invented terminology. During the interview with the UK Ecolabelling Competent Body Mr. Paul Jackson, Principal Scientist[9] (February 1997) indicated that there is no reason to invent new terminology when existing ones describe the same activities and they recommend ISO terminology - because of its international authority; and because the ISO series are more closely related to the product as they develop LCA methodology and guidelines for eco-labelling.

[9] Mr Jackson the Principal Scientist of the UK Ecolabelling Board of Executives is responsible for the technical assessment of applications; compliance monitoring; and development of criteria.

The final model aims to be a generic *model* related to companys' environmental policy and targets affecting the environmental impact of product design. The final model is tested and evaluated, in order to demonstrate the validity of the method.

7.2.3 Method - EMCS model evaluation Phase B.

The final format of the EMCS *model* that includes the sub-models was further assessed in one-to-one evaluation. The evaluation followed a pre-arranged structured format according to an *interview schedule*. The aim of the structured format of the interviews was to provide consistency in the data gathering and analysis.

Synthesis of testing

The *interview schedule* used an *evaluation questionnaire* applied mainly for assessing the EMCS *model* and also an assessment matrix as an extension in the use of the *model*. The potential interviewees contacted from a specified list (see below) with the request to offer a day and time to be interviewed. The aims of the interview were explained. Subjects that agreed to participate in the model evaluation received in advance by post the *evaluation questionnaire* and copies of the model with documentation explaining how the model operates. The duration of the interview based on the *evaluation questionnaire* was about twenty minutes apart from the free discussion that took place at the end of the interview.

Tested Participants

The potential subjects for evaluating the final modified format of the EMCS model were subjects contacted at previous stages of the research. The selection of the potential participants were under five conditions: (1) all the subjects took part in this investigation were from those that contacted in a previous stage of the research and expressed an interest to conducted again later in the research progress, (2) the companies of the subjects should have environmental activities and (3) the potential respondent should be partially involved or wholly responsible for such activities so they can be in the position to make substantial recommendations for alterations on the model, (4) it also included respondents that had previously indicated that their companies do not have environmental activities or they have but not properly developed (*that means they do not have an established environmental policy but take consideration for example, of the existing environmental legislation applying to their business)* the aim was to test the level of understanding from those that were unaware or not very informed of environmental management principles, (5) considerations about the size of businesses are also included in order to get sample from businesses with all the levels of profit margins and turnover.

Tested Instrument

The evaluation questionnaire used for testing the modified format of the EMCS *model* consists of nine items, from those three are supported by a second item or provide suggested options for selection. The reason for that was to provide more specific directions in the enquiry made. The questionnaire which follows aimed to investigate attitudes in relation to EMCS *model* however the aspect of the matrix also discussed. In more details the instrument used for the final format of the EMCS evaluation is presented in table VI.3 in appendix VI.

1) Do you believe that the use of terminology is appropriate?
  1a) Does the terminology describe adequately the stages indicated?
2) Are the EMCS model and the sub-models self explanatory from one stage to another?
  2a) Do you understand the directions and the links provided?
  2b) Please state if something is missing or not described adequately.
3) Do you think there is enough information and direction provided?
4) Do you find the model effective for use by packaging companies?
5) If the packaging companies used the EMCS model how often do you believe they should repeat their activities?
6) Do you think that the assessment matrix works well in conjunction with the EMCS model?
7) Do you believe that the EMCS model and the matrix provide useful guidelines for packaging companies to manage and assess their environmental performance?
8) Who do you believe could use the model?
9) Do you have any suggestion for inclusion on the final model?

7.2.4 Results - EMCS model evaluation Phase B.

A content analysis is used to analyse the data obtained from the face-to-face interviews (see Table VI.3 in appendix VI.). Twenty two interviews were conducted in this investigation. The business activity of the interviewees were seven packaging retailer/manufacturers, four paper and board suppliers, five environmental consultancies and six design consultancies. The profession of the subjects were seven Heads of Production/ Managers/ Directors, five Packaging Specialists/ Specifiers/ Engineers, five Packaging Designers (Head of Design/ Chief designers) and five Environmental Advisors.

For this evaluation the modified format of the EMCS model was tested, this includes the main model and five sub-models about: environmental auditing activities; operation method for internal and external communication; operation at product level; and operation format for packaging design. In addition to the models a complementary document explained in detail the process models supplied to the participants for evaluation. The tested format of the EMCS *model* that took part in this investigation was similar to the one presented in the following section 7.3. However, even if the format of the EMCS *model* presented in section 7.3 is the final format of the model, there are differences with the format of the model

evaluated in this section. Those differences between the tested format in Phase B. and the one presented later in this thesis (7.3) listed in the part of recommendations for improvements follow.

Subjects felt that the modified format of the EMCS model was an extremely good interpretation of environmental management principles applicable for packaging design. Subjects found the model to have a practical application and potentials to be used by environmental managers, environmental auditors and design managers. In addition subjects felt that the model can also be used by an independent environmental auditor/ consultancy and design /consultancy as a problem solving techniques, so the companys' products may be able to meet assessment ecological criteria. Finally subjects believed that the model can also be used by an accreditation/ certification body on environmental management system.

Moreover, subjects felt that the model provided clear and precise step-by-step direction on how to proceed in achieving environmental performance initiatives. In addition, that the use of terminology is easy to understood and the sub-models work well and explain the points in support of the main model.

Recommendations for changes are presented below. All the recommendations are included in the modified format of the model presented in table 7.5, 7.6, 7.7, 7.8, 7.9 and 7.10 in the follow section.

⇒ in the sub-model describing the auditing activities the wording between establishing the audit and running the audit should be change from 'the scope' to 'define the scope' for a better description of the process.

⇒ in the sub-model of operation method at external communication, it has been recommended the wordings describing the activities to be followed in each stage should be used in a reverse order. That means for example, the first stage should be described as 'identification approach' with the explanation '*market needs*' and, not 'market needs' with the explanation *'identification approach'* as it was. In addition, wording at the stage seven suggested to change from 'feedback - *informative approach*' to 'informative approach - *feedback, disseminate results'*.

⇒ in the sub-model of operation method at internal communication, it has been recommended the wording at the stage four to change from 'evaluate options' to 'evaluate options for improvements' also, the wording at the stage seven to change from 'feedback - *devising*' to 'communicative the results - *feedback, devising the findings*' and, wording at

the stage eight to change from 'future improvements - *generating*' to 'investing in future improvements - *generating new enquiries'*.

⇒ in the sub-model of operation at product level the wording 'eco-design characteristics' should be amended to 'eco-design considerations'.

⇒ in the sub-model of operation format for packaging design the 'environmental declaration, eco-labelling' should be replaced by 'eco-points - environmental declaration' as this is the suggested option by the research to be used as an extension in the use of the model, also the word 'accreditation' could be added as this is in general the process described in that box. In addition in the column that stated the 'eco-design considerations' the environmental needs and market needs should presented together as are closely related and, the document explaining the use of the model should present what these considerations involve.

For the period of registration suggested to be every three years however, there should be annual reviews to check that the operation runs efficiently.

The concept of the assessment matrix presented in chapter 8. was also evaluated: subjects were very supportive of the use of the matrix as extension of the EMCS model. In particular subjects felt that the matrix provided valuable specifications for paper packaging as a part of the EMCS *model* to formulate decisions for packaging design. Subjects also found the use of the Eco-points appropriate for paper and board packaging. In addition, subjects found the use of the checklist for packaging design which accompanied the design factors of the matrix (see 8.3) to be very useful in formulating decisions for packaging design and also for checking and controlling the packaging design process.

Moreover, subjects found that if the matrix is going to be used by an accreditation body further work is required to specify the use and appearance of the eco-points on packaging products. Further research is needed to identify the period of registration. However, it was recommended that the period of registration can be for two years but this might vary depending on packaging specifications. For example, technological improvement that took place during this period of registration should be considered.

7.3 The Environmental Management Control System EMCS *model*

The *model* of environmental analysis/assessment is a design management process model that assists companies in auditing and evaluating design activities related with packaging. The EMCS *model* attempts to account for the development of companys' strategy which demonstrates a keen interest in taking the environment seriously and adopting a proactive environmental marketing strategy which has to be honest, truthful and communicative. The Environmental Management Control System *model* (EMCS *model*) works as a strategic management tool in the managerial decision making process for a company.

The scope of the EMCS *model* is to provide the foundation for management mechanism for examining and auditing in a social and ethical context the companys' environmental initiatives whilst in the meantime safeguarding their products and packaging environmental acceptability in the market place.

The EMCS model is based on the following five principals:

1. **Communication** - *building an open communication system.*
2. **Corporation** - *involvement and participation at a broad corporate level.*
3. **Compliance** - *review to adopt and anticipate existing legislation and standards.*
4. **Auditing** - *monitoring of environmental activities and process improvements.*
5. **Statement** - *evaluating and presenting environmental process and achievements.*

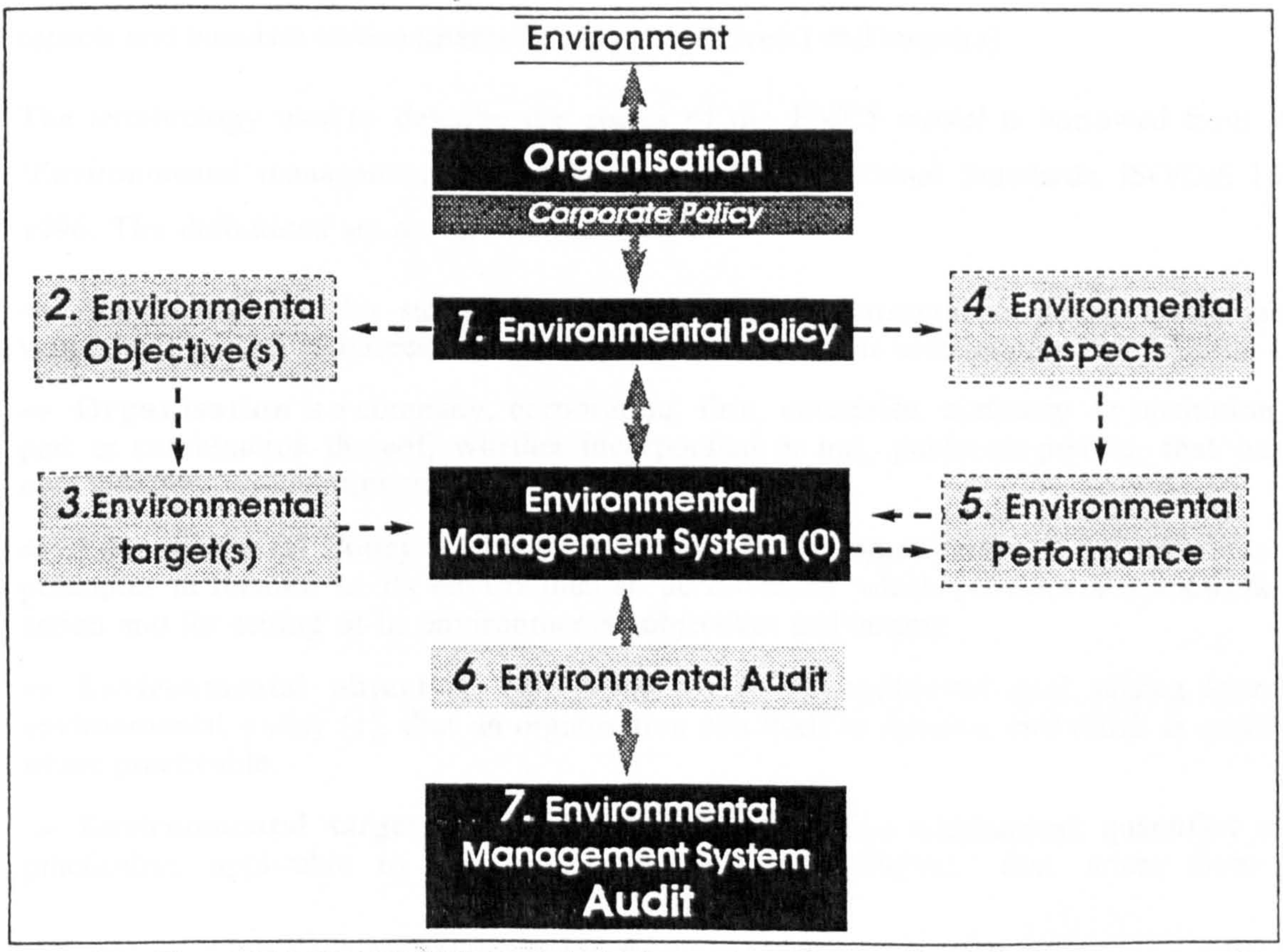


Figure 7.5 The EMCS *model* - An overview of the operation process

The operation process of the EMCS *model* is presented in Figure 7.5. It is clearly indicated that the environmental policy (1) is an extension of the organisation's corporate policy and influenced by considerations regarding the impact of the organisation on the environment in which its operation and the consumption of goods that the organisation produced take place. The environmental policy delivers environmental objectives (2) that sets goals to be achieved. Further specific environmental targets (3) arise from the environmental objectives. These target(s) can apply to the operation of the organisation as a whole for example, minimising the overall energy consumed in the manufacturer facilities. Target(s) can also apply for a particular aspect for example reducing the emissions in water pollution from the bleaching process; or for a particular product for example, reducing the amount of paper packaging materials. Environmental targets specify in more detail how the objectives can be met.

The environmental policy (1) including environmental aspects (4) based on the size of the packaging businesses, related with business activities and the packaging products that are produced. Environmental management system (0) reflects the organisational structure and components required to implement the environmental policy (for a specific definition see below). Environmental performance (5) estimates the efficiency operation of the components required to implement the environmental policy (for a specific definition see below). Environmental performance (5) estimates the efficiency operation of the environmental management system reflecting the efficient use of the environmental aspects and based on environmental policy, objective(s) and target(s).

The terminology used to describe the stages of the EMCS *model* is borrowed from ISO, 'Environmental management - Vocabulary', Draft International Standards, ISO/DIS 1450, 1996. The definitions are as follows:

⇒ **Environment** is the surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation.

⇒ **Organisation** is a company, corporation, firm, enterprise, authority or institution, or part or combination thereof, whether incorporated or not, public or private, that has its own functions and administration.

⇒ **Environmental Policy** (1.) is the statement by the organisation of its intentions and principles in relation to its environmental performance which provides a framework for action and for setting of its environmental objectives and targets.

⇒ **Environmental objective** (2.) is the overall environmental goal, arising from the environmental policy (1), that an organisation sets itself to achieve, and which is quantified where practicable.

⇒ **Environmental target** (3.) is the detailed performance requirement, quantified where practicable, applicable to the organisation or parts thereof, that arises from the

environmental objectives (2) and that needs to be set and met in order to achieve those objectives.

⇒ **Environmental Aspects** (4.) is an element of an organisation's activities, products or services that can interact with the environment.

⇒ **Environmental Management System** (0.) is part of the overall management system that includes organizational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy.

⇒ **Environmental Performance** (5.) is the measurable results of the environmental management system (0) related to an organisation's control of its environmental aspects (4), based on its environmental policy (1.), objectives (2) and targets (3)

⇒ **Environmental Audit** (6.) is a systematic, documented verification process of objectively obtaining and evaluating audit evidence to determine whether specified environmental activities, events, conditions, management systems, or information about these matters conform with audit criteria and communicating the results of this process to the client.

⇒ **Environmental Management System Audit** (7.) is the systematic, documented verification process of objectively obtaining and evaluating audit evidence to determine whether an organisation's environmental management system audit criteria, and communicating the results of this process to the client.

The EMCS *model* aims to be flexible in order to make it possible to be adopted by organisation of any size.

7.4 Sub-models: Recommendations for product environmental management

The following sub-models give specific directions for packaging companies about: a) environmental auditing activities, b) the use of environmental management system to examine the internal and external operation level of a company, c) the operation of the EMCS at product level, and d) the operation of the EMCS for managing eco-design considerations for packaging design.

EMCS model - Environmental auditing activities

To implement an environmental management system, environmental audits are employed to control and provide measurements against specific tasks related with a company's environmental policy. Figure 7.6 describes the part of the EMCS model that deals with environmental auditing[10] activities.

The first stage of establishing an environmental audit is to set the audit criteria by the audit team that might exist in the company (or by employed an external environmental auditor). Audit criteria defined by ISO 1450: 1996 as the *'policies, practices, procedures or*

[10] For discussion about environmental auditing see chapter 2.7.

requirements against which the auditor compares collected audit evidence about the subject matter.' The audit criteria provides the scope of the environmental audit.

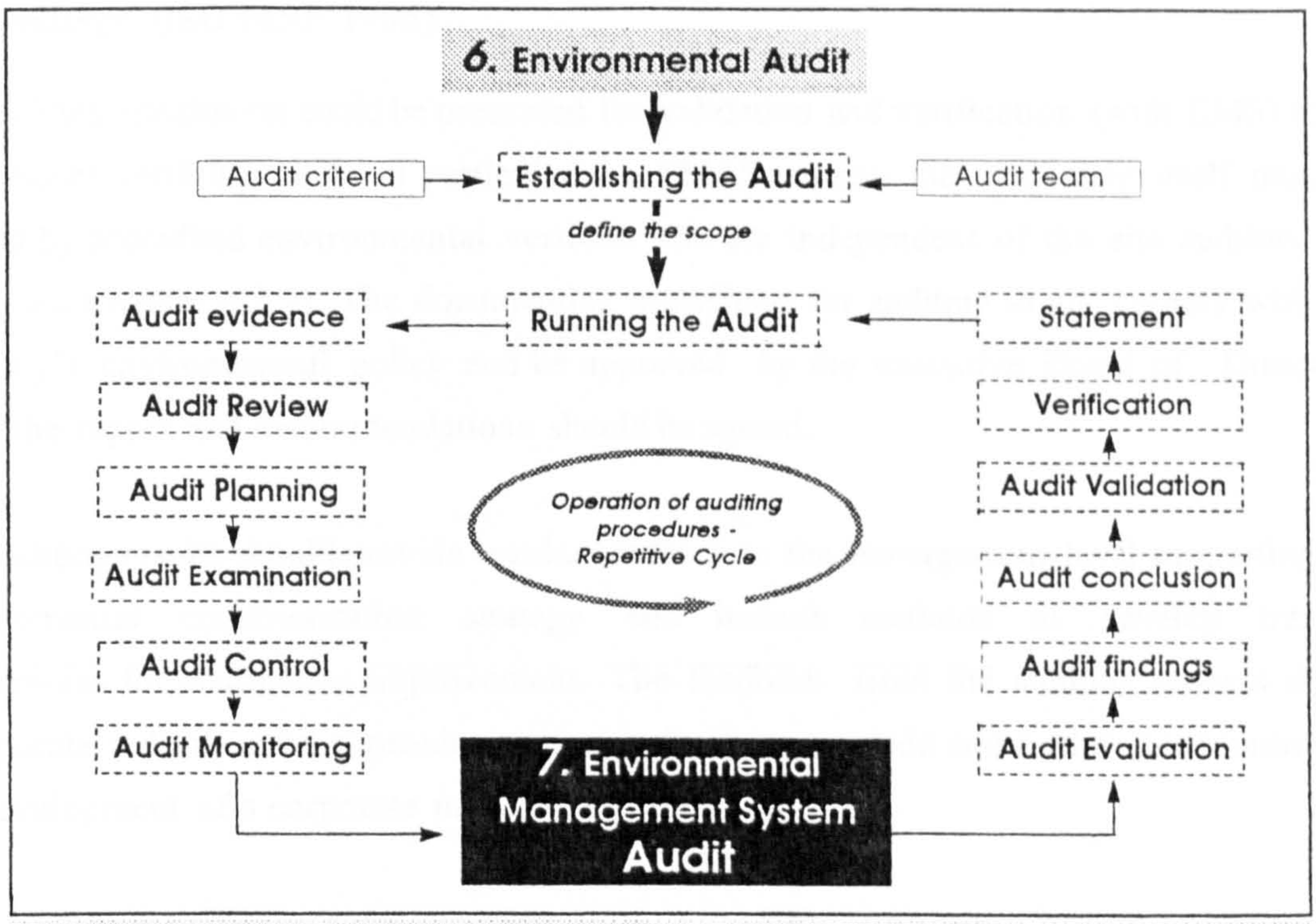


Figure 7.6 The EMCS *model* -Environmental auditing activities

The audit starts with the audit evidence that are '*verifiable information, records or statements of fact*' (ISO 1450: 1996). The audit team should gather relevant information to access performance and evaluate best options for environmental investment in a cost effective way. The form of collecting information could be through: surveys, site visits and interviews. An important part of the auditing operation is the involvement of the staff, who need to be educated and motivated in environmental issues. Background baseline information about for example existing market situation, best environmental practice examples, environmental legislative requirements and competitors initiatives required to be collected. Review planning and examining the audit procedures are stages closely related as a part of the audit evidence.

Important elements during auditing operation are regular monitoring and control to facilitate the efficient auditing process and to ensure that it follows the agreed audit criteria. The auditing review exercise should be taken into account the different levels of understanding within the organisation, the suppliers and buyers. The results of the audit and the auditing process should be evaluated by the company's auditing or/and environmental management team. The audit findings is the '*result of the evaluation of the collected audit*

evidence compared against the agreed audit criteria' (ISO 1450: 1996). The audit conclusion *'is the professional judgement or opinion expressed by an auditor about the subject matter of the audit, based on and limited to reasoning the auditor has applied to audit findings'* (ISO 1450: 1996).

The auditing conclusion could be presented for validation and verification (with EMS) to an independent verifying body. In particular the EMAS requires that the audit itself must be verified by accredited environmental verifiers who are independent of the site auditors (for EMAS see Chapter 6.3.1). The documenting procedures for auditing should comply with the company's environmental policy and be approved by the executive Board of Directors, where the report and recommendations should be agreed.

The auditing results should provide regular feedback to the management level supporting the environmental communication strategy and include methods to develop training programmes for continuous improvement. The feedback from the auditing process should incorporate a decision on approximate timing for the next audit and further contribution to the development of a corporate management strategy.

The audit should be reported by presenting the strengths and weaknesses of environmental assessment in the light of findings, so that the format of environmental reporting could work as a source of reference for other similar business activities. The documentation of the audit, Duty of Care (European Recycling Conference/Seminar Programme: 1995), is a mechanism which leads towards the development of an environmental management strategy. The final report should be disseminated to all parties concerned and should be formatted in such a way as to ensure accuracy and understanding at all levels. Also important is the way that the environmental information is presented and, according to a 1996 study from the Department of the Environment the quality of environmental statements (ESs) has shown some improvement since 1991. But over half ESs failed to meet all the legal requirements and only one-third met good practice standards.[11]

EMCS model - Operation method for internal and external communication

The use of an environmental management system to examine the internal and external operation is described in Figure 7.7 and 7.8 The External Communication Level *(Figure*

[11] Quality of environmental statements held back by poor 'Scooping', The Ends Report, No 256, May 1996, Environmental Data Services Ltd

7.7, EMCS model - Operation method of external communication) include eight stages as follows:

1) In the first stage the environmental manager (or management team), examined market needs about environmental requirements, knowledge and understanding. Efforts should made by the environmental manager to understand the market and anticipate market requirements for environmental products and services. In particular the environmental manager should identify markets trends and explore possible profitable opportunities for investment on 'green' products or services.

2) The second stage required information to be collected about the markets requirements for environmental products and services indicated as good opportunities for investment on the above stage. Information could be regarding other similar existing products and services. Research could also take place on existing surveys and statistics.

3) The evaluation of the findings could generate some more specific results about market environmental requirements for example, in the introduction of a new product. But if there are not enough answers collected it might be worth considering to estimate public needs and opinions by conducting a survey.

4) The above information could bring a number of conclusions considered as 'messages' that the market gives in response to company's investigation.
That is regarding for example the introduction of a new packaging product, the design brief that is coming from the marketing team of the company.

5) The evaluation of the 'messages' bring different options and estimate possible solutions.

6) The next stage examine the best possible solutions as a qualitative approach.

7) If the solution is implemented, the achievement should be reported in the company's annual report for example (or on products information sheets or in the press magazines/journals etc.) aiming to inform the public, investors, stakeholders, interested groups and any other party concerned aiming to generate feedback.

8) The process should be repeated after specific period of time (determined by the environmental manager) with the aim to contribute in continuous improvements.

The Internal Communication Level *(Figure 7.8, EMCS model - Operation method of internal communication)* addresses the business appreciation of environmental risks and assesses the targets for present and future achievements. The eight stages to be followed for internal communication improvements start with identifying the problem that should be dealt with for example, staff unaware of company's environmental policy or not well motivated to participate in good housekeeping - for example in the use of energy, materials or facilities within the organisation.

Chapter 7. The Final Model

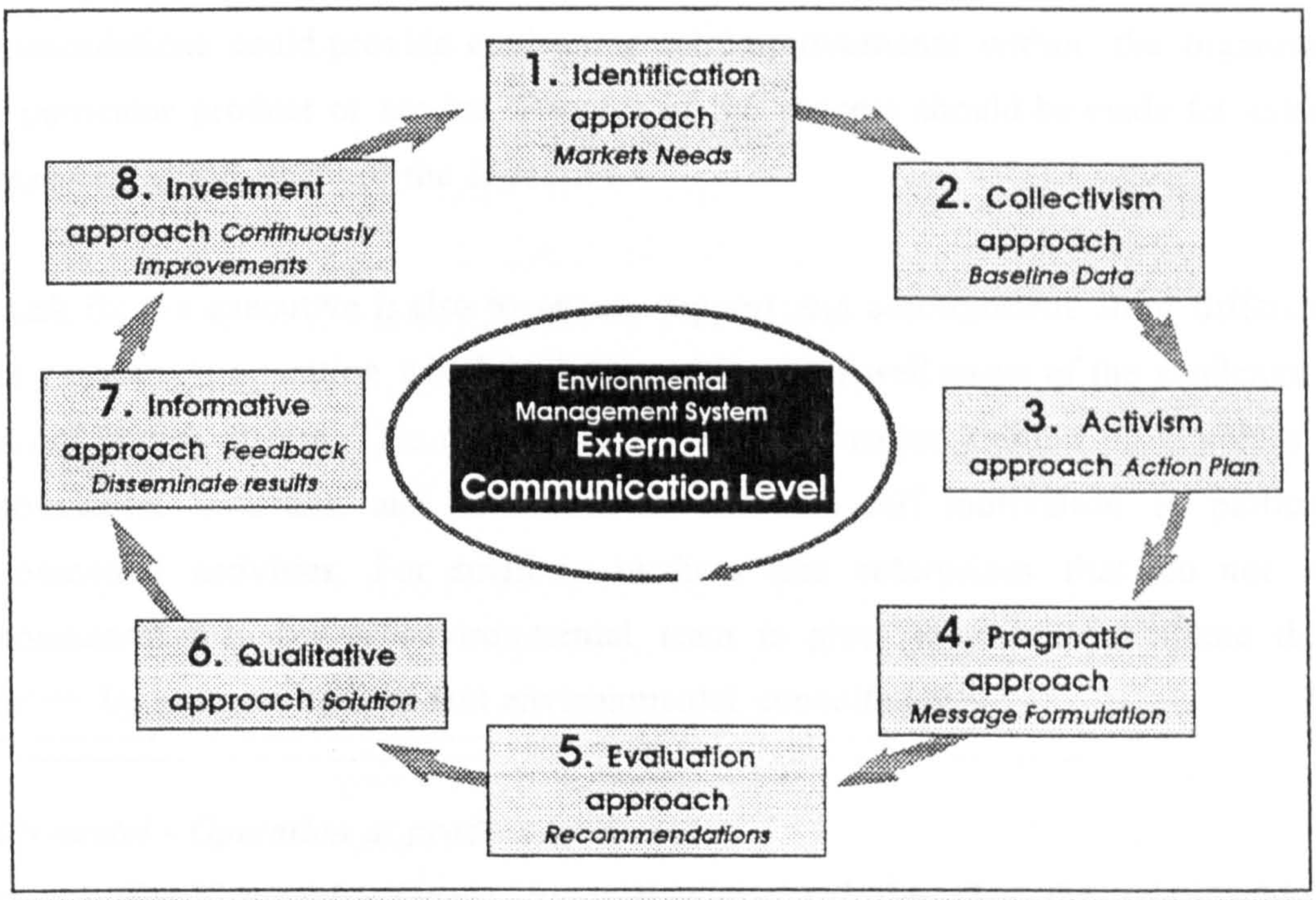


Figure 7.7 The EMCS *model* - Operation method of external communication

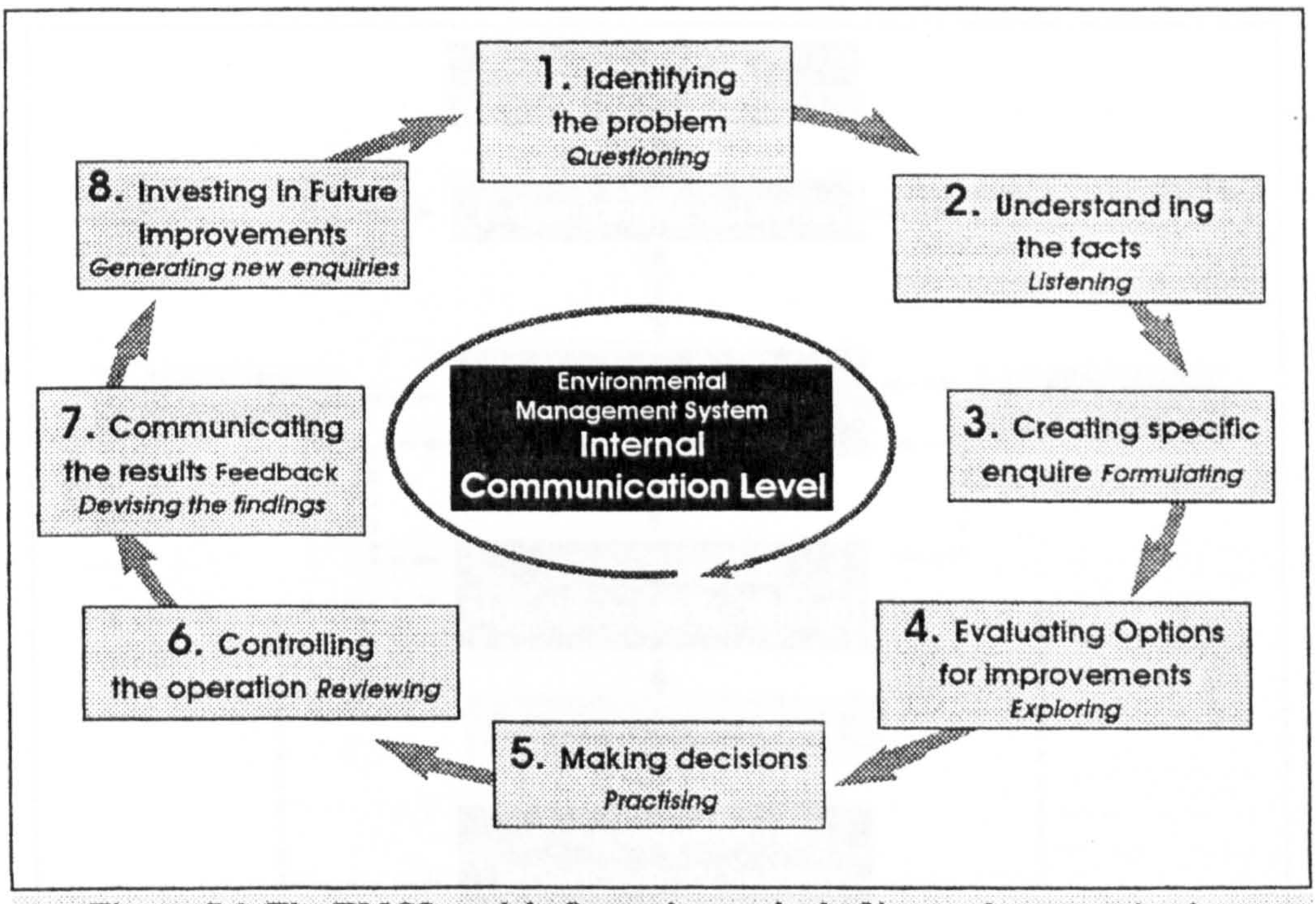


Figure 7.8 The EMCS *model* - Operation method of internal communication

The management team should understand the facts that cause the problem, communicate with employees in the organisation and suggest solutions that reflect future improvements. Also this process of listening to the employees and considering their views, suggestions and recommendations could provide environmental improvements within the organisation or for a particular product or service. Records of the process should be made for internal use and reported to the Board of the Directors.

The task for the executive is also to ensure support and commitment from different levels of the company's operation which includes making staff well aware of the challenge and the targets of improvements. This could be managed by particular training programmes to raise environmental awareness and commitments and also self motivation to participate in environmental activities. For small or medium size enterprizes that do not have an environmental manager or environmental team in place they could facilitate the above operation by using an independent environmental consultancy.

EMCS model - Operation at product level

Figure 7.9 *EMCS model - Operation at product level*, describes the relationship of the environmental management with the product.

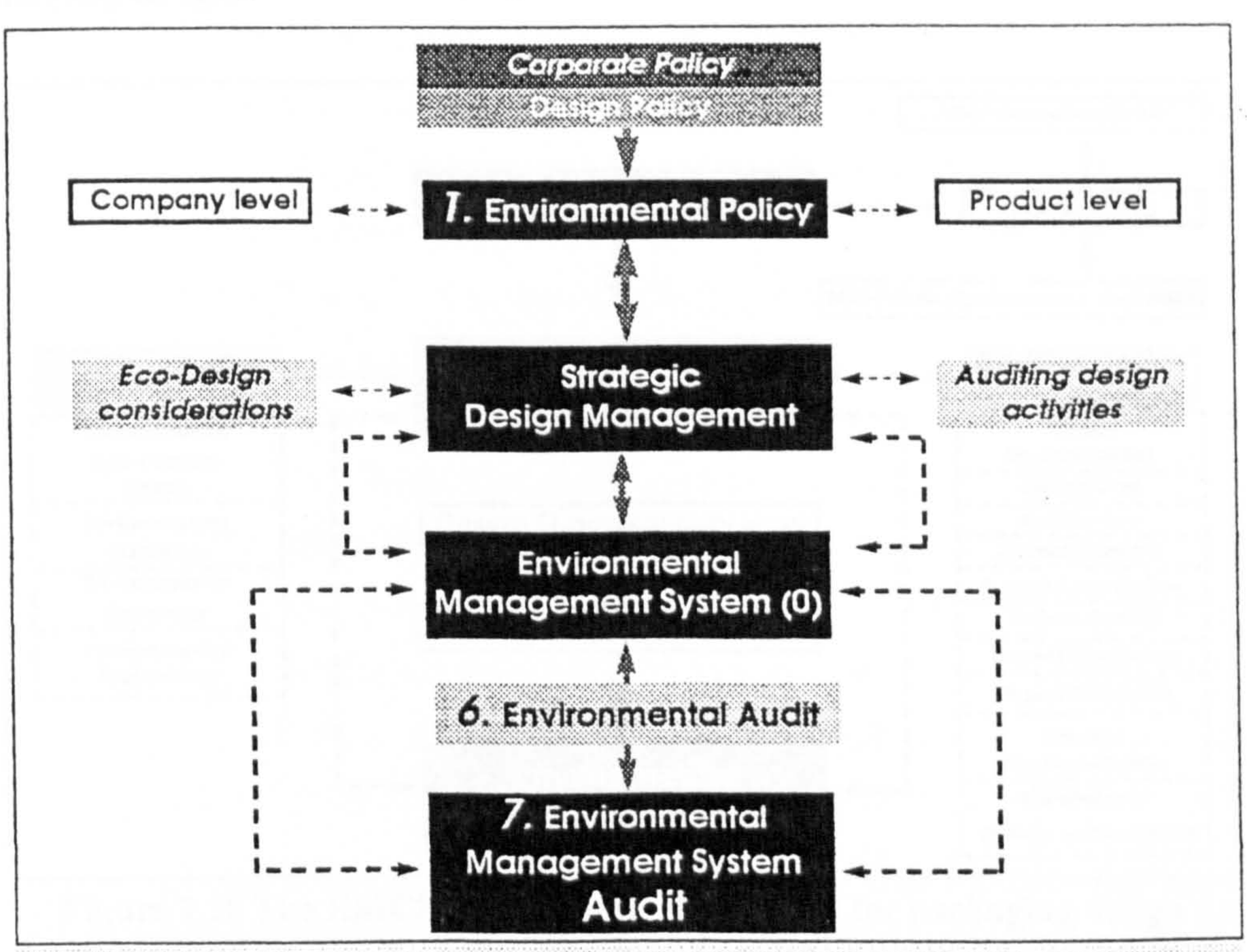


Figure 7.9 The EMCS *model* - Operation at product level

The environmental policy that considers aspects of the corporate policy and design policy formulated to have effects at company level and product level. To implement the

environmental policy at product level design management needs to be employed as it can provide better understanding of how the policy can effect the product and how design abilities can support the company's environmental image. These abilities of the design management reflect in the operation of the environmental management system.

The design management at strategic level considers the characteristics of Eco-design that are related with the product to be produced and auditing the design activities towards the final design solution. The environmental audit (6) can used to give information particularly in relation to the manufacturing process for example the environmental impact of a particular machinery that is going to be used for the manufacture of the product.

EMCS model - Operation format for packaging design

Figure 7.10 '*The EMCS model - Operation format for packaging design*' is based on the figure 7.9 '*The EMCS model - Operation at product level*'. Figure 7.10 provides specific information for the Design Manager to manage the formulation of packaging related with company's environmental policy and environmental management system. The role of strategic design management is emphasised in auditing and controlling the design activities for packaging design.

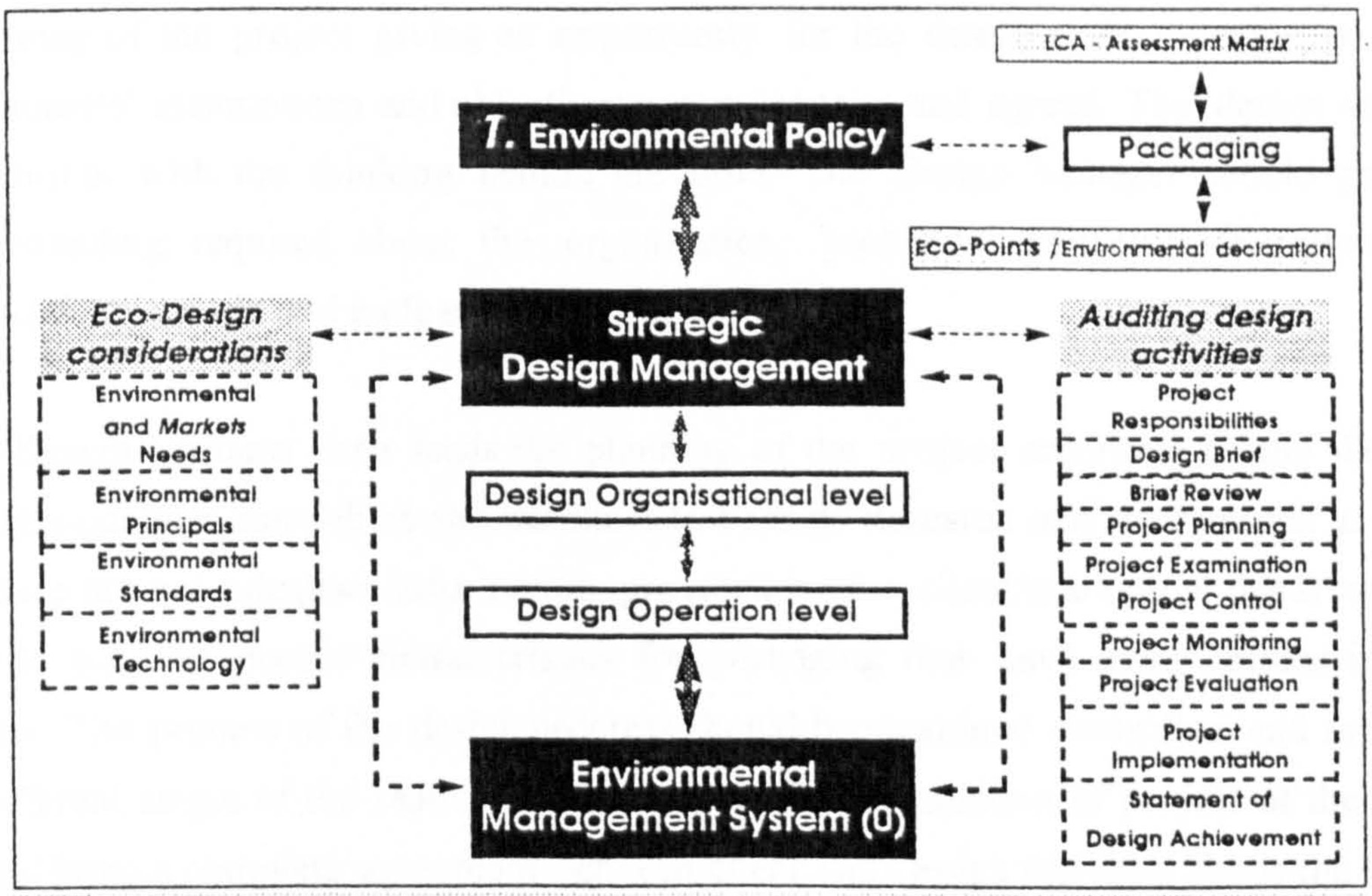


Figure 7.10 The EMCS *model* -Operation format for packaging design

The role of the Design Manager is described in terms of strategic design management that considers the eco-design characteristics of packaging.

In particular, specific ecological design considerations are as follows.

⇒ ***Environmental and Market Needs*** considerations include: Environmental conscious behaviour. - Environmental policy and companys' action plan. - Awareness of ethical environmental purchasing. - Open environmental information system. - Corporate responsibility. - Pressure groups *such as Consumer and Environmentalist.* - Waste management. - Pollution prevention. - Culture change.
⇒ ***Environmental Principals*** considerations include: Waste minimisation. - Recouping energy. - Reducing weight. - Reducing material usage. - Pollution control - Using recycling/ reusable/ returnable/ refillable/ closing the loop systems. - Designing for durability and sustainability. Investing on continuos innovative environmental improvements.
⇒ ***Environmental Standards*** considerations include: Legislative, regulatory standards. - Governmental plants/ political parties influence. - Eco auditing regulations/ suppliers audit. - Eco-labelling regulations. - Pollutants control. - Developing sustainable standards. - Implementation and control. - Re-examining and re-developing standards.
⇒ ***Environmental Technology*** considerations include: Clean technology. - Operation control . - Alternative technology. - Energy conservation. - Industrial ecology concepts. - Environmental investment. - Scientific research and development. - Materials research e.g. biodegradability. - Minimising operation risks. - Elimination of toxic chemicals. - Control environmental impact.

In auditing design activities the first issue to be decided is who is responsible for the different stages of the project development and what human resources are required. The brief for the packaging coming from the marketing department (or from the client in the case for example of design consultancies) should be discussed in detail to avoid confusion later in the project and interpreted in a design brief. The design brief should be reviewed at the beginning of the project giving an opportunity for the design team to make sure that all fundamental assumptions and objectives are understood and agreed. The design team should be familiar with the thinking behind the brief. The Design Manager should provide the understanding required about the organisation, problems, strategy, operational issues, financial objectives and budgetary constraints.

The Design Manager then leads the planning of the project according to the decided brief giving guidelines, timetables and deadlines to be met. Research may be required at that stage (if there are not adequate information provided by the client/marketing department) about how to achieve specific characteristics for packaging that have been decided in the brief review. The process of the design progress should be examined controlled and monitored at in different stages of the realisation design brief. The evaluation of project at the final stage should bring a complete agreement between client and Design Manager about the objectives, constraints and scope of the work. The project implementation is the final design of the packaging. The company should present the final packaging product in the environmental publications produced, emphasising what is the contribution that the particular packaging

has in minimising its impact on the environment. This information should supplied as a part of the strategic management operation within the company.

7.5 Requirements and specifications

In implementing the model the following limitations should be noted:

Lox (1992) indicates that there are a number of reasons that can often distort the results or soften the reality of findings when conducting an environmental analysis at product level (regarding packaging).[12] There are a number of considerations that might twist the results of the environmental analysis for paper packaging including:

⇒ The access to resources and the distance between mining and processing - these differ from one paper mill to another as well as from one country to another;

⇒ The ways in which electricity and/or forms of mechanical energy are produced. Electricity from water power is likely to be different from an environmental point of view than electricity from heat either produced by combustion of fuels or from nuclear fission reactions;

⇒ The technology of processing. The extraction of sulphur, e.g. from fuels or the treatment of combustion gases to absorb sulphur dioxide enhances other waste-streams and energy uses;

⇒ The description and the delineation of the system boundary considered can be different. The energy content of waste can be taken into account as a negative energy content. For example, energy which can be recovered as heat and/or as electricity [1/4 of heat]); recycling; re-use or reprocessing (e.g. remelting of plastic scrap or of collected post-consumer paper and board materials) are different. So the production processes of materials include waste disposal or recycling (from 'cradle-to-grave' or from 'conception to resurrection')

⇒ The LCA depends upon the size of delivered product.

Observations and Recommendations

The final outcome of this research study is the EMCS *model*, a generic structural model that leads the way in assessing business environmental initiatives compatible with the packaging design process. The model is a response to the interest expressed by packaging businesses (see 1.2.1) to invest in Environmental Management Systems (EMS) rather than eco-

[12] Lox, F (1992) Packaging and Ecology, PIRA International, pp. 244-245

labelling. The findings from the second evaluation of the model showed that the model can be used by companies of any size. However, the model aims to be applicable more to large enterprises mainly for two reasons. Firstly because the findings from the second survey (see 6.3.2) revealed that big companies expressed more interest about EMS than smaller companies. Secondly changes in the organizational behaviour at big enterprizes could bring quantifiable changes in the system properties and can influence society as a whole.

The model is designed for paper and packaging companies, to the managerial decision making process of the company and thus includes the design manager and environmental manager. The model can also be used by an independent environmental auditor, consultancy or advisor and design /consultancy as a problem solving technique, so the client companys' products are able to meet assessment ecological criteria. The model can also be used by an accreditation body in order to provide guidelines for business on how to proceed in conducting environmental analysis and further to use the model to control such process.

7.6 Summary

This chapter presents the evaluation of the EMCS *model* in two phases. Phase A. deals with the evaluation of the first format of the *model* and tests recommendations and considerations for improvements made at the previous research stage. In addition the other prototype formats of the model of environmental analysis are examined in interviews aiming to draw out considerations for inclusion in the final format of the EMCS *model.* Following this at phase B., the final format of the EMCS *model* is assembled following the evolutionary prototyping approach and tested again in one-to-one evaluation. The results of the evaluation confirmed the usefulness and practicality of the EMCS *model* as a strategic design management model that effectively demonstrates how to proceed in achieving and develop environmental initiatives within packaging business. More specifically the EMCS *model* can effectively support environmental optimisation for packaging products related with and with effects to packaging companies environmental management systems when it is designed according to the proposed structure provided by the model and sub-models.

Further recommendations for the use of the EMCS *model* is the theme of the next chapter where the use of an assessment matrix for paper packaging products is discussed as an option for rating the practical application of the model in measuring the different levels of environmental performance. Three mini case studies are used as examples to demonstrate the potential of the matrix.

CHAPTER 8. FURTHER RECOMMENDATIONS *Using an assessment matrix for paper based packaging*

8.1 Introduction

The EMCS *model* presented in the previous chapter recommended the methodology to be followed in order to audit, monitor and control environmental management systems compatible with the packaging design process. This chapter expands the use of the *model* by suggesting a new protocol of 'assessment matrix' in order to differentiate paper packaging products environmental performance. The assessment matrix works as an extension for the use of the EMCS *model* and emphasises the practical role of the *model.* Three *vignette* case studies are presented as examples of the use of the matrix.

8.2 The concept of an assessment matrix

The matrix assessment concept is used to graphically represent the comparisons made between several responsible environmental options for product design and to determine their relative level of environmental merit. Typically the use of the matrix template consists of two components: (a) a matrix system graphically and qualitatively summarising the status of a particular environmental option across the product life-cycle; and (b) an accompanying documentation package explaining in detail and quantifying where possible the information contained in the matrix cells.

ASSESSMENT MATRIX					
			PRODUCT LIFE-CYCLE		
Environmental fields	**Pre-production**	**Production**	**Distribution** (Including Packaging)	**Utilisation**	**Disposal**
Waste relevance.					
Soil pollution and degradation.					
Water contamination					
Air contamination					
Noise.					
Consumption of energy.					
Consumption of natural resources.					
Effects on eco-system.					

Table 8.1 EU Ecolabel Assessment Matrix Source: Commission Information on Eco-Labelling, Jan. 1993

The EU ecolabelling award scheme regulations contains a matrix to guide the assessment process, and this is reproduced as Table 8.1. The EU eco-labelling scheme's matrix is one of the most common matrix in use. Under the EU scheme ecological criteria are defined for each product group on the basis of a "cradle-to-grave" assessment that analysed the environmental impact of the product group in a complete life-cycle starting with the

extraction of the raw materials, progressing through the production, distribution and use phases, and ending with disposal after use. At each phase, the effects on all environmental media are considered (Commission Information on Eco-Labelling, Jan 1993).

8.3 EMCS model - Packaging specifications

The new EMCS *model* provides direction for packaging businesses to conduct environmental management systems in relation to effects of product design and packaging. Based on recommendations made for the extensions in the use of the model at the *Testing and Evaluation* stage of the research, the first phase of EMCS *model* tests a matrix concept that examines a number of factors in relation to the design and manufacturing process, legal implications as well as social and environmental performance initiatives. The assessment matrix developed as a possible extension in the use of the model and aims to quantify those factors and measure them against the packaging products life-cycle stages.

Before the matrix is presented step by step, considerations that apply to completion of the matrix are examined.

Design considerations for paper based packaging

Based on legislative and environmental requirements the challenges facing designers today are to re-evaluate whether there is a need for over-packaging, to examine recycling concepts, explore how to use new materials (lightweight for example) and learn how to convert and process new technology into something that the consumers can use effectively. These new environmental restraints should not be limitations to the designer who must remain open to new ideas and use creativity to improve the packaging function. The designer is now in the position of helping businesses to improve their environmental performance by taking into account market environmental requirements and current environmental and legislative trends and using new technological environmental efficient concepts combining with eco-design skills to integrate products with minimum environmental impact.

The following checklist is based on legislative regulatory requirements on packaging and packaging waste, and comments made during stage phase A. of the investigation about paper based packaging design specification. It was also presented for evaluation to twenty-two subjects who participated in the evaluation of the final format of the EMCS model and a few modifications took place.

To examine and minimise the environmental impact when designing with paper and board material, specific questions should be addressed as follows.

Checklist for Paper & Board Packaging Design

Questions	Yes	No
Product and Graphic Design		
√ Does the design consider the environmental impact of the packaging from 'cradle-to-grave'[1]- from the extraction of raw materials until the final disposal as waste? √ Is the product packaging designed to make it easy to separate the constituent materials? √ Does the combination of materials create problem for recycling? √ Is the packaging designed to minimise the packaging weight? √ Is the packaging designed to minimise the packaging volume? √ Does it apply to environmental legal liabilities? √ Does it use the least possible material? √ Is the packaging designed to utilise recycled materials wherever possible? √ Can concentrated products be developed, that fit into smaller packs? √ Does it have any extra environmental benefit? √ Does it carry honest and reliable environmental information for consumers? i.e. *Does the information provided and the overall appearance of the pack encourage the efficient use; re-use and disposal of the pack and the its content?* √ Are recycling instructions clearly printed on the packaging itself? √ Is there a design management co-ordinator? - *Is there enough information collected to evaluate the most suitable environmental option for a packaging line? Does the whole design process operate efficiently? Is appropriate training given to designers and marketers to understand eco-design concepts?*		
Process Design	**Yes**	**No**
√ Does the design process consider the use of the maximum possible amount of recycled material rather than virgin material? √ Does the process utilise energy management approaches to minimise energy use? √ Does the process utilise the use of equipment to minimise usage energy? √ Has the impact on the environment in all life cycle stages been considered? √ Is there any system in place for checking and collating information about environmental implication of different materials and process? √ Has available information or other companies' environmental practices been reviewed and considered?		
Materials Minimasition and Design	**Yes**	**No**
√ Is excess packaging material recycled rather than landfill or incinerated? √ Does packaging ensure the use of the more lightweight materials available,		

[1] See chapter 2. for 'cradle-to-grave' and life-cycle analysis/assessment methodology.

without compromising the protection and safety requirements of the packaged product? √ Has packaging materials entering the manufacturing facility been minimised, and designed to use the fewest possible different materials?		
Design Considerations in Material Selection	**Yes**	**No**
√ Has material reduction been considered? √ Has material substitution been thoroughly considered? √ Can a percentage of recycled materials over virgin materials be specified? √ Do any proposed materials come from sustainable management forest? √ Does any proposed material have potential disposal problems? √ Does the production of packaging materials have an adverse effect on the environment?		
Design for Recycling	**Yes**	**No**
√ Does the product minimise the number of different materials that are used in its manufacture? √ Are recycling facilities provided where the product is consumed? √ Is information for recycling clearly displayed on the pack?		
Product Packaging and Transportation	**Yes**	**No**
√ Can the products packaging - secondary or tertiary packaging be eliminated? √ Is transportation packaging design integrated with product packaging design to eliminate for example volume (unused space on the transportation packaging container); weight? √ Are alternative packaging systems evaluated against one another in a structured way? √ Have efforts been made to use recyclable packaging materials? √ Have efforts been made to use refillable or reusable containers where appropriate? √ Are arrangements made to take back product packaging for recycling or reuse?		

Table 8.2 ***Checklist for paper and board packaging design***

The above checklist for paper and board packaging design is recommended to be used as part of the Assessment Matrix for paper based packaging 'Stage One: Design Factors' (table 8.6). The considerations and desirable actions pertaining to each matrix element of the stage one are described by the above checklist and recommendations specific to the type of facility under evaluation. Design Managers should use the checklist by answering the questions provided when formulating the design brief for a paper packaging product. The answer to the question 'Yes' should be indicated by '+' cross mark; the answer 'No' should be indicated with '-' minus mark; and, if the question is not applicable by a slot mark '/'. The summary of the results should be used in table 8.6 of the assessment matrix.

Additional environmental considerations for packaging design include:

⇒ Examining the suitability and the overall cost of the packaging aiming to meet all the product requirements at the minimum overall cost.

⇒ Assessing the efficient use of energy requirements during production; transportation and distribution.

⇒ Assessing the effective use of raw materials (minimise the use of material where appropriate; avoid overpackaging etc.) and processing (using for example mono-material).

⇒ Assessing the impact and the use of waste arising at each stage of processing and distribution.

⇒ Assessing the impact of post- consumer waste.

⇒ Include design consideration that gives the packaging the ability to be re-used, recycled or incinerated.

⇒ Avoid pigments containing toxic elements.

⇒ Identify materials to assist disposal, using approved symbols

Specifications for paper based packaging

Virtually all countries producing significant volumes of pulp and paper have set standards with respect to air and water pollution. In most countries approaches to standards setting predominate in the regulatory arrangements of technology based options. The actual regulations vary widely between countries, and in some cases between regions within countries. Increasingly, regulatory approaches place strong emphasis on source reduction and clean production methods. Many national and regional standards and parameters for the pulp and paper industry are well established, including biochemical and chemical oxygen demand (BOD and COD), total suspended solids (TSS), NOx and particulates, for air emissions; and controls on the movement and disposal of solid wastes.

The International Institute for Environment and Development (IIED) commissioned the consulting firm Jaakko Poyry to estimate current world-wide emissions from the pulp and paper industry, in order to assess current environmental performance and the costs required for the global industry to reach a good level of environmental performance. Jaakko Poyry also compiled a set of discharge and emission standards which were representative of international guidelines for pulp and paper mills and the average standard of technology world-wide. These are listed below in tables 8.3 and 8.4.

Table 8.3 Waste Water Discharge Guidelines for Pulp and Paper Mills

Process	**TSS** Total suspended solids	***Kg/tonne of product*** **COD** - Biochemical oxygen demand	***Kg/tonne of product*** **BOD** - Chemical oxygen demand	**AOX** - Absorbable organo - halogens
Bleached Kraft pulp	7(5)	70(25)	15(4)	2.0(0.8)
Unbleached Kraft pulp	7(4)	40(10)	8(2)	n/a
Unbleached sulphite pulp	7	140	30	1.5
Semi-mechanical pulp	7(4)	60(25)	15(5)	n/a
Mechanical pulp	7(3)	40(15)	10(4)	n/a
Non-wood pulp	7(3)	140	30	1.5
Recycled fibre	5-10	20-50	10-20	n/a
Paper	3(1)	10(1)	4(0.5)	n/a

Numbers in brackets indicate levels that can be reached by modern mills with primary and secondary treatment. - Source: IIED Sub-Study No. 8 (1996) 'Towards a sustainable paper cycle', International Institute for Environment and Development

Table 8.4 Air Emission Guidelines for Pulp and Paper Mills

Pollutant	**Emission Level kg/tonne of product**	
Solid particulates	<6	
Sulpur Dioxide (SO_2)	<4 from process area	<5 from energy generation
Nitrogen Oxides (NOx as NO_2)	<3	

Source: IIED Sub Study No. 8 (1996) 'Towards a sustainable paper cycle', International Institute for Environment and Development

According to the International Institute of Environment and Development (IIED, 1996: 119) most mills should be able to meet the guideline levels either with extensive internal measures or with adequate external effluent systems. Although many smaller mills are currently exceeding these guidelines. Mills with modern internal technology as well as primary and secondary effluent treatment systems should be able to reach the lower emission levels indicated in brackets.

Flexo and gravure printing are used for paper and board packaging and both solvent and water based inks are in use (for environmental effects for paper based packaging see Chapter 2.9) The environmental advantages and disadvantages of alternative inks for paper printing compared by IIED (1996: 141), are presented in table 8.5.

Table 8.5 Environmental advantages and disadvantages of alternative inks

	Mineral Oil-Based	Vegetable Oil- Based	Water-Based	UV-Cured
Current use	Most common type of ink for all uses at present	Used mainly on newspaper	Widely used for flexo and gravure inks.	Used in rotary letter presses and greater use expected in flexo printing in the future
VOC emissions	Emit highest proportion of VOCs of any inks.	Minimal	Minimal	None
Ease of De-inking	Relatively easily removed and do not affect recyclability	Much harder to remove but can be removed with peroxide.	Less effective and more costly wash removal process required.	Harder to remove.
Other advantages and disadvantages		Offer technical benefits for a similar price when used in coloured inks compared to mineral oil-based inks. Black inks are more costly.	Water based gravure inks require greater energy input to the drying process and give lower quality colour printing compared to conventional inks.	Require greater energy input in the drying process.

Source: IIED (1996) 'Towards a sustainable paper cycle', International Institute for Environment and Development, p 141

The above information provides some quantifiable data to be considered by packaging companies and paper mills. The information presented on tables 8.3, 8.4 and 8.5 providing consideration for inclusion in the manufacturing factors assessment matrix (see table 8.7). The assessment matrices presented below includes consideration for the Design Manager regarding the life-cycle stages of paper based packaging. Emphasises should be given to the early stage of product development since the design decisions of the packaging affect the manufacturing process, distribution, consumer use and disposal.

8.3.1 Assessment matrix for paper and board packaging

The assessment matrix suggested by this study follows the life-cycle stages indicated by the EU Ecolabel assessment matrix (see table 8.2) however emphasis has been given to considerations regarding design decisions. The Assessment Matrix for paper based packaging examines the product life-cycle stages against four factors that determine product environmental impact. These factors include: the design factors, manufacturing factors, legal/social factors, and performance factors. Tables 8.6, 8.7, 8.8 and 8.9 present these factors to be considered for paper based packaging life cycle development stages.

Each assessment matrix template for paper based packaging (see Tables 8.6, 8.7, 8.8 and 8.9) has two axis, one presenting the life cycle stages of the packaging and the other consisting of issues categories bearing on the suitability of the option under evaluation. The '*Design Factors*' matrix looks at the design considerations that should influence and determine the manufacturing process and the product in use.

Paper based packaging Life cycle stages

	Pre - Production	Production	Distribution	Use	After - Use	Disposal	Outputs *Summary*
Design Factors							
Resource Consumption							
Material Availability							
Material Reduction							
Material Compatibility							
Components Compatibility							
Process Compatibility							
Energy Consumption							
Pollution Reduction							

Table 8.6 Stage One: Design Factors - Assessment Matrix for paper based packaging

Paper based packaging Life cycle stages

	Pre - Production	Production	Distribution	Use	After - Use	Disposal	Outputs *Summary*
Manufacturing Factors							
Resource Consumption							
Material Compatibility							
Components Compatibility							
Process Compatibility							
Energy Consumption							
Water Contamination							
Air Contamination							
Manufacturing Waste							

Table 8.7 Stage Two: Manufacturing Factors -Assessment Matrix for paper based packaging

Paper based packaging Life cycle stages						
Pre - Production	**Production**	**Distribution**	**Use**	**After - Use**	**Disposal**	**Outputs** *Summary*
Legal/Social Factors						
Forestry Certificate						
Comply with Legislative Regulatory requirements						
Suppliers Audit						
Considering Community Needs						
Motivate Employments						

Table 8.8 Stage three: Legal/Social Factors - Assessment Matrix for paper based packaging

Paper based packaging Life cycle stages						
Pre - Production	**Production**	**Distribution**	**Use**	**After - Use**	**Disposal**	**Outputs** *Summary*
Performance Factors						
Cost benefit analysis						
Competitors position						
Adopt EMS						
Communicate Environmental Activities						
Investment in Environmental Improvements						

Table 8.9 Stage Four: Performance Factors - Assessment Matrix for paper based packaging

The *'Manufacturing Factors'* matrix focuses on the implications of each option in terms of the manufacturing activity itself. The *'Legal/Social Factors'* matrix looks at legislative/ regulatory issues affecting paper packaging production as well as social issues regarding the use of environmental information on packaging products (under the heading of 'community needs'). Finally, the *'Performance Factors'* matrix includes considerations regarding the cost of the product packaging, and positioning of the company in the market in terms of competitors as well as designed to capture business activities related with environmental management systems (EMAS, BS 7750, ISO 14001 discussed in chapter 2).

These assessment matrices for paper based packaging are simplified and a more comprehensive list could compile several factors (e.g. toxicity of materials) and options (for example in social factors about workers health and safety issues) under each factor for investigation. But the assessment matrix produced by the study assesses the main areas for environmental investigation toward reducing the environmental impact of packaging products and assessing the company environmental profile that produces such products.

This interpretation of the assessment matrix for paper based packaging allows the company to clearly indicate the level of its environmental commitments regarding packaging design, the manufacturing process, legal compliance, social image and company's environmental performance related to and with effects of the final packaging that is produced. This formulation of the Assessment Matrix gives the chance for the company to clearly indicate how the design decisions at the early stage of the product development influence the other products' life-cycle stages.

The assessment matrix for paper based packaging is a tool for design managers to create design briefs and assess design considering the environmental areas indicated in the 'design factors' by answering the questions provided in Table 8.2 *Checklist for Paper and Board Packaging Design*. Also, Design Managers have to bear in mind the other factors of the assessment matrix for example, compliance with the EU packaging and packaging waste directive (indicated under the legal factors of the assessment matrix), cost benefit analysis and competitors position under the performance factors that should affect design decisions.

Recommended ways for use

The scope of the assessment matrix for paper packaging products is that the different stages are easy to understand by designers and design managers as well as by people responsible for packaging production such as technical staff in the manufacturing process, marketing department and accounting.

It should further explain the concept of assessment matrix in scoring different levels of '*environmental concern*'. The entries in the matrix system have four possibilities as levels of consideration *'no concern'*- described with a white oval symbol; *'minor concern'*- illustrated with a light grey oval symbol ; '*moderate concern*'- appear with a dark grey oval symbol; and, *'significant concern'* - with a black. oval symbol (see Figure 8.1 Matrix Symbols). Where a category is inapplicable to the option under consideration it is indicated by a straight line through the cell.

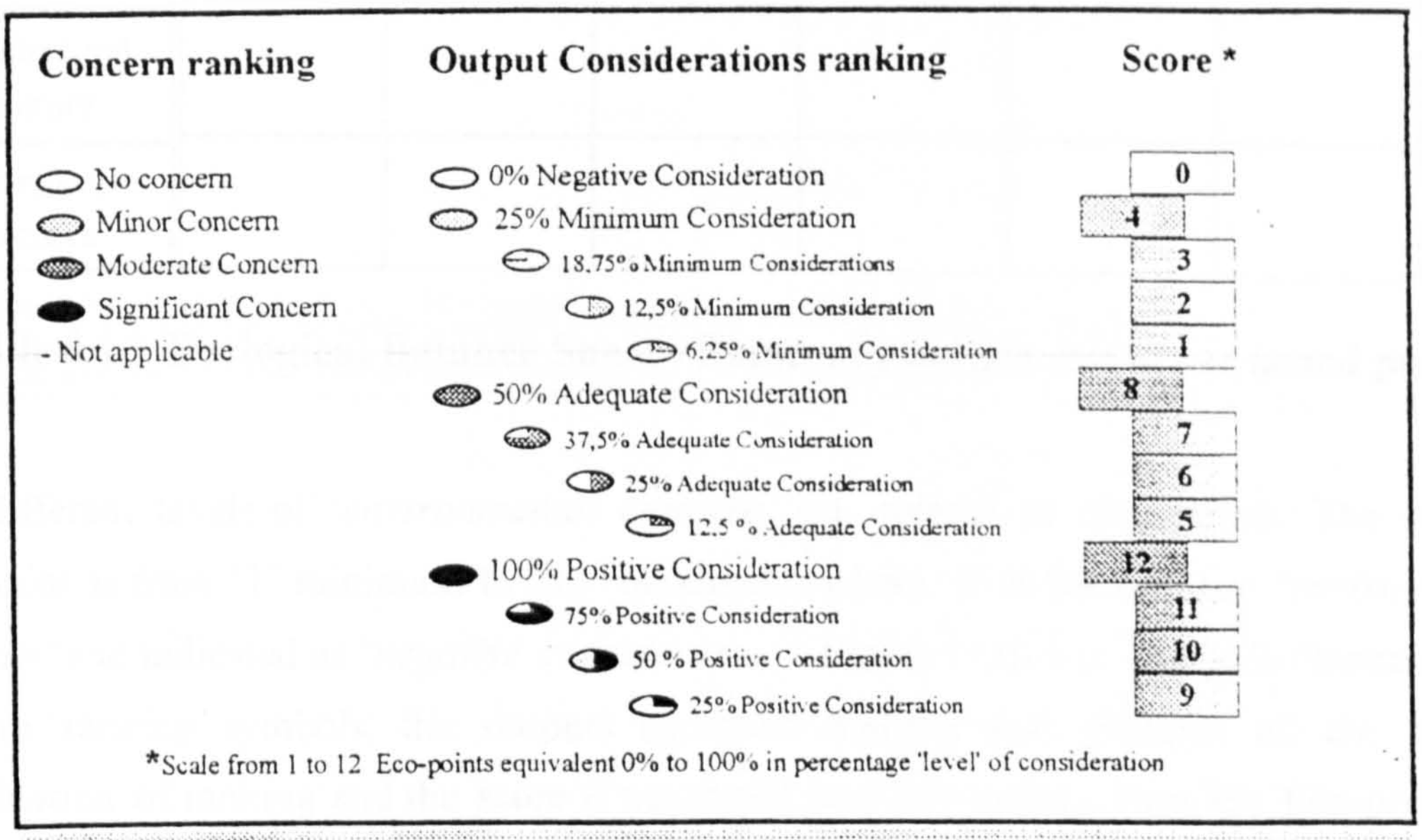


Figure 8.1 Matrix Symbols - *Symbols to be used in the matrix cells to indicate degrees of environmental concern in Packaging life cycle stages and symbols to be used for the final output rating*

The degree of concern in each level of consideration is indicated by a percentage. For example, when it appears 75 per cent *'positive consideration'* in the 'Design Factors' assessment matrix regarding the 'components compatibility' means that the company examines the environmental issues related with the use of cardboard in the design process the compatibility of the material in the manufacturing process and product use and found the level of environmental impact in each stage of packaging life-cycle and make constant efforts to minimise the impact, even if in one area the reduction of the environmental impact might has not been achieved one hundred percent based on the existing specification although the reduction of the impact should be close to the specifications.Upon completion of the each stage of the assessment matrix for paper based packaging each matrix is given an overall degree of environmental 'consideration' assessment. These grouped assessments are then transferred to a summary matrix the 'Ecological Balance Sheet' (Figure 8.10) that displays the results of the assessments of the individual matrix elements.

Paper based packaging Life cycle stages

	Pre - Production	Production	Distribution	Use	After - Use	Disposal	Outputs *Summary*
Design Factors							
Manufacturing Factors							
Legal/social Factors							
Performance Factors							

Table 8.10 Ecological Balance Sheet - Summary matrix for paper based packaging

The different levels of '*environmental concern*' are treated as Eco-points. The scale of Eco-point is from '1' minimum to '12' maximum, where '0' is for not any '*environmental concern*' and indicated as '*negative consideration*'. Figure 1. *Matrix Symbols* illustrates the concern ranking symbols, the outputs considers ranking that presents all the possible combination of ranking and the score is translated into Eco-points. How the Eco-points are awarded in the different stages of packaging product life cycle are explained (see 8.3.2).

Evaluation of the use of an assessment matrix

The *Ecological Balance Sheet* Assessment Matrix for paper packaging products (Table 8.10) gives specifications for paper packaging as an extension in the use of the EMCS model to formulate decisions for packaging design. In particular the use of the Assessment Matrix offers the following benefits for paper packaging businesses.

⇒ give indication to measured against the environmental performance of paper packaging products in different stages of products' LCA,

⇒ consider the different levels of environmental commitments within paper packaging business, and

⇒ lead the way for an environmental declaration for paper packaging products.

8.3.2 Methodology for recording and evaluating outcomes

The ranking symbols indicate the different levels of the environmental concern related with and as a result of business activities. The output considerations are illustrated in Figure 8.1

Matrix Symbols give all the possibilities of different rankings. The score indicated in a scale starting from '0' Eco-points equivalent to none ' negative consideration' to '12' Eco-Points for 100 percent 'positive consideration'. The Eco-points awarded for the environmental concern indicated, in the different stages of paper based packaging life-cycle are as follows:

⇒ **Pre-production** stage awarded with '5' Eco-points in consideration of:

1. *'Product Brief'* delivered from the marketing department or the client score with '1' Eco-points if it includes environmental considerations for packagings' life-cycle;

2. *'Design Brief'* that formulated with environmental considerations about for example, the use of material; examine options for using recycled material; reducing the volume of packaging etc. Awarded with '1' Eco-point.

3. '1' Eco-point goes as well in the *'packaging compatibility with the packaged product'* for example, a packaging that is designed to fit exactly the size/volume of goods without leaving any unused space for no reason. An Eco-point will not be awarded for excessive packaging that is used as promotional material for the packaged product;

4. In the 'initial production' design solution will also awarded '1' Eco-Point if it succeeds to met the brief and implement the environmental considerations set as challenges for design;

5. Because the use of material is of importance in terms of environmental considerations for paper based packaging '1' Eco-point awarded for the 'material selection'.

⇒ **Production** - stage awarded with '1' Eco-point because if the above environmental considerations are well delivered, providing a design solution for packaging with a minimum environmental impact then, the *'process manufacturing'* with up-dated machinery will operate efficiently.

⇒ **Distribution** - awarded '2' eco-points, one eco-point for the energy and pollution efficiency use of *'transportation'* and one point for the 'tertiary packaging' used.

⇒ **Use** - consumer use also take '1' point.

⇒ **After-use** - options (set by the EU legislation on packaging and packaging waste) that provide for reuse/recycling/ refill awarded with '1' Eco-point, if the packaging offers other alternative uses (e.g. insulation material or as 'animal food') that extends its life-cycle to end up as waste awarded with '1' Eco-point.

⇒ **Disposal** - if waste management options are considered by the producer of the packaging one eco-point is awarded in this stage.

The pre-production stage is awarded with the most eco-points since decisions in this stage influence all the other stages in the packaging product life-cycle.

Specifications for the use of the matrix

It is recommended the assessment matrix is completed by the environmental manager of the company (matrix on tables 8.6, 8.7, 8.8 and 8.9). *Stage One, Design factors - assessment matrix for paper based packaging* (table 8.2) should be completed by the Design Manager (chief designer, or head of design) of the company in collaboration with the environmental manager. The Eco-points should be awarded by an external environmental auditor (or auditing team) after a site inspection.

Another use of assessment matrix in the reverse order, is each stage of the matrix - *design factors; manufacturing factors; legal/social factors; performance factors;* - to be used to provide indication for areas of environmental concern for the company to take action regarding its operation, packaging products or activities.

8.4 Implementation proposals and evaluation

The 'Ecological balance sheet' (Table 8.10 *Ecological balance sheet - Summary matrix for paper based packaging*) is compatible with the EMCS *model* in three ways:

1. The Assessment Matrix designed to be used in conjunction with the EMCS *model.* If a paper packaging company use the EMCS *model* to manage and control its environmental activities the use of the *Assessment Matrix* measures these activities.

2. The ranking in each matrix are communicative information about a company's environmental activities, and could presented to the stakeholders, investors, public, interested groups and be could included in the annual report (as complimentary information).

3. Each assessment matrix examines and rates design factors; manufacturing factors; legal/social factors; performance factors. So it is possible to use each of those assessment matrix areas of concern in a reverse order by indicating areas to be considered when formulating the EMCS model.

Also it is important to support and explore environmental guidelines through feasibility studies and addressing the implications for standardization of development for products environmental acceptability. To make informed decisions about reducing the negative and enhancing the positive impact of packaging, it is essential to have a picture of the complete system and the physical nature of the product it is going to contain. By using the different assessment matrix templates for paper based packaging a list of factors provided to be examined.

8.4.1 Instruments used for *vignette* case studies

In order to explore the practical application of the assessment matrix three case studies are used as examples in the use of the matrix - the number of case studies recommended during the interview with the UK Ecolabelling board (see 7.2.2) The stages for producing the case studies were:

1st The use of a questionnaire investigating paper and packaging businesses environmental activities (the questionnaire used in the survey presented in chapter 6).

2nd The analysis of the findings from the questionnaire and the evaluation of companies environmental publications created specifications for formulating the case studies.

3rd The use of the above materials to produce three case studies that present the environmental activities of the company under investigation and the completed matrix.

4th The evaluation of each case study with the company's officials.

5th The presentation of the case study based on the recommendations made from the previous stage.

The format of the case studies is presented in the following section (8.4.2, 8.4.3 and 8.4.4) but first, more details of the methodology used for the selection of the case studies and the evaluation methodology used for assessing the validity and reliability of the case studies is examined.

The selection of vignette case studies

The selection of the case studies is from those paper and packaging companies participating in the survey *'Environmental Effects on Business Management and Information System'* (see Chapter 6). One item of the questionnaire asked the respondents to provide copies of their environmental publications. Seventeen out of the sixty four subjects have sent with their completed questionnaire their environmental report, in the form of annual environmental reports, company's newsletters and environmental leaflets about their products and services. The criteria for selection for the three case studies were as follows.

⇒ The selected companies should provide information about all their environmental activities, define clearly the objectives and targets of their environmental policy, specify if possible their involvement with EMS (EMAS or ISO 14001 for example) and talk about legal and social implications of their environmental performance.

⇒ The companies should provide information about current and future targets for their packaging design activities, emphasis is on a 'cradle-to-grave' approach.

The above information allows the researcher to complete the assessment matrix for paper based packaging. The three case studies are examples from companies that were conscientious about their environmental performance and activities, for the assessment matrix to be completed.

Instruments used in the evaluation of vignette case studies

For the evaluation of the case studies the companies that are presented in the case studies were contacted with the request to participate in assessing and confirming the credibility and reliability of the presented material. Each participant in the evaluation received by post a copy of the project description, the matrix tables and the document explaining how the matrix operates. Also, a copy of the EMCS *model*, the document explained how the model works and a copy of the case study for their company. In addition a covering letter was included and one page evaluation questionnaire. The evaluation questionnaire contained the following six items.

1. Is it easy for you to understand the use of the assessment matrix that this study recommends?
2. Do you find the information on the Case Study about (*enter company name)* Environmental profile give a good description of your companys' environmental activities?
3. Do you find adequate enough the ranking scoring in each matrix for your company?
Please feel free to suggest any changes.
For this purpose a blank copy of the four stages of the matrix are provided.
4. Do you think that the assessment matrix works well in conjunction with the EMCS model?
5. Do you believe that the EMCS model and the matrix provide useful guidelines for packaging companies to manage and assess their environmental performance?
6. If you like to offer any comment about the EMCS model/ the matrix or the research project it would be considered extremely valuable.

Results from the evaluation of vignette case studies

The position of the subjects took part in this evaluation were Fine Papers Environmental Adviser, *Arjo Wiggins Fine Papers Ltd*, Engineer responsible for environmental issues from *AssiDomän Packaging Manufacturer* and Head of Design from *Aston Packaging*. The findings (see Table VII.3 in Appendix VII) revealed a tendency of agreement in the way that the matrix was completed. However some modifications were suggested in the format of the case studies that includes that the information presented in the case study of the Arjo Wiggins Fine Papers obtained from two separated environmental reports that they marketed differently and not two different versions of the same report as it was mentioned in the case study that was sent for evaluation. Moreover the subject from Aston Packaging offered additional information about his company environmental activities and he also commented that: '*the EMCS model provides a useful guideline and I believe the matrix*

allows a good summarisation of the direct issues concerning companies' environmental responsibilities'.

The suggestions for improvements included in the case studies presented in the following sections.

8.4.2 Vignette Case Study One *Aston Packaging*

From Aston Packaging a folder with information sheets about the company and on different products, and special information pack about *'The Aston Packaging Standard Box Re-use System'* and some issues of its own Newsletter 'CorruLink' was received.

Aston Packaging Ltd - *Environmental Profile*

Aston Packaging is currently one of the leading packaging manufacturers in the UK and also operates in other countries around the world. Established in 1917, it has constantly refined and adapted its design and production methods to ensure high quality effective products which are both environmentally responsible and competitively priced. Aston Packaging recycled its own corrugated paper waste off cuts which constitutes 30% of the material content of its moulded paper pulp products. Aston Packaging making significant energy cost savings by using low heat dehumidifier ovens that recycle warm air and produce distilled water as a by-product.

Aston packaging Limited gives emphasis in design and packaging recyclability aspect, and ship all products out on refurbished timber pallets. The information pack about *'The Aston Packaging Standard Box Re-use System'* presented specific environmental initiatives about paper based packaging. Such environmental initiatives include:

- Boxes reused on average of three times (small size) and eight times largest sized boxes.
- Aston packaging will pay up to 70% of the original cost for reusable returned boxes.
- The standard box re-use system considered by Aston packaging as a good 'marketing tool' that may be used to offset recycling responsibilities (*environmental packaging legislation*).
- Aston recycle the boxes collected.

In addition to the box reuse system a similar timber pallet reuse system is in place.

Aston Packaging Ltd- *Assessment Matrix*

Below is the evaluation of the scoring in each stage on the assessment matrix. The scoring is indicative as it is derived from the information provided.

⇒ ***Aston Packaging Ltd - Stage One: Design Factors Assessment Matrix for paper based packaging.*** See Table VII.1.1 in Appendix VII for indicative *'consideration'* ranking.

⇒ ***Aston Packaging - Stage Two: Manufacturing Factors Assessment Matrix for paper based packaging*** Not enough information provided.

⇒ ***Aston Packaging - Stage Three: Legal/Social Factors Assessment Matrix for paper based packaging.*** See Table VII.1.1 in Appendix VII for indicative *'consideration'* ranking.

⇒ ***Aston Packaging - Stage Four: Performance Factors Assessment Matrix for paper based packaging.*** See Table VII.1.1 in Appendix VII for indicative *'consideration'* ranking.

Paper based packaging Life cycle stages

	Pre - Production	Production	Distribution	Use	After - Use	Disposal	Outputs *Summary*
Design Factors	●	●	●	●	●	●	●
Manufacturing Factors							*
Legal/social Factors	●	●	●	●	●	●	●
Performance Factors	●	◕	◕	●	●	●	●

Table 8.11 Aston Packaging Ltd Ecological Balance Sheet - ***Summary matrix for paper based packaging***
**Not any information provided*

Aston Packaging - Ecological Balance Sheet Assessment Matrix for paper based packaging
The output considerations ranking are for *'Design Factors'* is 100% positive consideration; for *'Manufacturing Factors'* not any information provided; 'Legal/Social Factors' 100% positive consideration; and, 'Performance Factors' 100% positive consideration; The total output of the summary ranking is 100% positive consideration the results scoring '12' Eco-Points for the three assessment factors - manufacturing factors not included. The Table 8.11 presents the summary evaluation matrix *Ecological Balance Sheet* for Aston Packaging.

8.4.3 Vignette case study Two *Arjo Wiggins Fine Papers Ltd*

From the Arjo Wiggins Fine Papers Ltd received the 1994 environmental report and the 1997 *'Arjo Wiggins Fine Papers Environmental Report'*.

Arjo Wiggins Fine Papers Ltd - ***Environmental Profile***

Arjo Wiggins Fine Papers Ltd is one of the five Division within Arjo Wiggins Appleton plc. It has four main production units in Europe, three of these are in the UK. The environmental policy of the Arjo Wiggins Appleton plc. (apply for the Arjo Wiggins Fine

Papers Ltd division) is stated as follow in *'Arjo Wiggins Fine Papers Environmental Report'* (1997).

1. Consideration of environmental issues and the prevention of pollution shall form an integral part of business decisions, activities and production processes.
2. Management systems and audits are to be used regularly to monitor environmental issues.
3. The selection of raw materials for the manufacture of products shall take into account their environmental impact.
4. The use of energy and all emissions are to be monitored continuously and reduced to the lowest reasonably achievable level.
5. The company will constantly seek to reduce quantity of waste generated by business and production process; to find productive uses for that waste; and to dispose of any residues by means which have the least environmental impact that can be reasonably be achieved.
6. The company on request provide to its customers advice on environmental issues relating to its products.
7. All employees are required to take into account the protection of the environment in the conduct of the Company's business.
8. The company will seek to encourage its suppliers, agents and contractors to have environmental policies similar to Arjo Wiggins Fine Papers.

Arjo Wiggins Fine Papers to face the responsibilities of the EU packaging and packaging waste Directive made corrugated packaging from recycled material and support the concept to develop LCA for packaging working closely with ISO standard.

Arjo Wiggins Fine Papers Ltd - *Assessment Matrix*

Below is the evaluation of the scoring in each stage on the assessment matrix. The scoring is indicative as it is derived from the information provided.

⇒ ***Arjo Wiggins Fine Papers Ltd - Stage One: Design Factors Assessment Matrix for paper based packaging.*** See Table VII.1.2 in Appendix VII for indicative *'consideration'* ranking.

⇒ ***Arjo Wiggins Fine Papers Ltd - Stage Two: Manufacturing Factors Assessment Matrix for paper based packaging*** See Table VII.1.2 in Appendix VII for indicative *'consideration'* ranking.

⇒ ***Arjo Wiggins Fine Papers Ltd - Stage Three: Legal/Social Factors Assessment Matrix for paper based packaging.*** See Table VII.1.2 in Appendix VII for indicative *'consideration'* ranking.

⇒ ***Arjo Wiggins Fine Papers Ltd - Stage Four: Performance Factors Assessment Matrix for paper based packaging.*** See Table VII.1.2 in Appendix VII for indicative *'consideration'* ranking.

Paper based packaging Life cycle stages

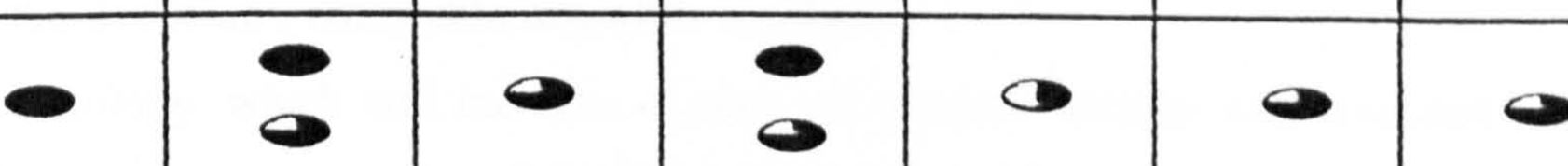
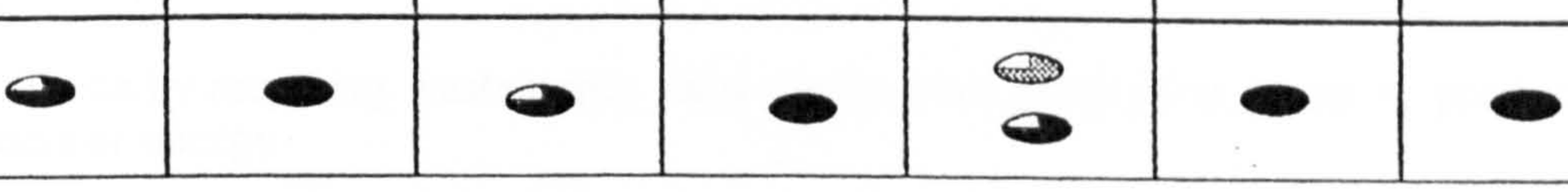
	Pre - Production	Production	Distribution	Use	After - Use	Disposal	Outputs *Summary*
Design Factors							
Manufacturing Factors							
Legal/social Factors							
Performance Factors							

Table 8.12 Arjo Wiggins Fine Papers Ltd
Ecological Balance Sheet - *Summary matrix for paper based packaging*

Arjo Wiggins Fine Papers Ltd - Ecological Balance Sheet Assessment Matrix for paper based packaging The output considerations ranking are for '*Design Factors*' 75% positive consideration; for '*Manufacturing Factors*' 75% positive consideration; 'Legal/Social Factors' 75% positive consideration; and, 'Performance Factors' 100% positive consideration; As most of the summary ranking is 100% positive consideration the results scoring '12' Eco-Points. See Table 8.12 for the *Ecological Balance Sheet*).

8.4.4 Vignette Case Study Three *AssiDomän Packaging Manufacturer*

The AssiDomän '*Environmental Report 1996*' and a prospectus titled '*A presentation of AssiDomän 1995*' are the materials supplied by the AssiDomän. Review of these materials provide information to complete the stages and the Ecobalance Sheet of the assessment matrix for paper based packaging.

AssiDomän - ***Environmental Profile***

AssiDomän (operates in many countries in Europe) recognise that its operations have an environmental impact and accept responsibility to reduce this impact on the environment as far as it is ecologically and economically reasonable. For AssiDomän commitment to long-term, sustainable development means to use as far as possible renewable resources to make products that are of maximum use with minimum consumption of resources.

AssiDomän states: '*protecting forests, water and air is crucial to the survival and development of our business. Our responsibility to the natural environment is the same that we owe to our customers, employees, shareholders and society in general*'.[1]

AssiDomän main environmental policy guidelines include:

- To seek continuous improvement throughout of products full life cycle;
- Sustainable forestry and protection of biological diversity;
- Conservation of resources, by economising on raw materials used, conserve energy and minimise the use of non-renewable materials and fuel;
- To use technology which will increase closure of process circuits and treatment of emissions;
- To reduce waste by recycling waste paper and use its own production waste to produce new products or energy.
- To encourage suppliers to meet the same standards of environmental awareness and openness that apply in AssiDomän environment;

AssiDomän main environmental measures include:

⇒ *Management Systems* - each AssiDomän business unit will have its own environmental policy that reflects the corporate policy , and its own systems for implementing environmental controls and audits. Employees will be given training and information to enable them to take responsibility for the environment in their daily tasks.

⇒ *Environmental Planning and Annual Environmental Audit* - Every year each AssiDomän business unit will establish improvement targets and a programme of action. The progress will reported in an annual environmental audit.

⇒ *Openness* - The way that AssiDomän deals with environmental issues aims to inspire confidence among their customers, employees and general public. AssiDomän will seek broad scientific co-operation and open dialogue with authorities, environmental organisations and their customers.

AssiDomän states in its Environmental Report (1996) that '*we will review the goals and methods regularly in the light of new infuriation*'.

AssiDomän Packaging has 70 production centres making sack and Kraft paper, packaging board, corrugated packaging and sacks.

AssiDomän - ***Assessment Matrix***

Below is the evaluation of the scoring in each stage on the assessment matrix. The scoring is indicative as it is derived from the information provided.

⇒ ***AssiDomän - Stage One: Design Factors Assessment Matrix for paper based packaging***
See Table VII.1.3 in Appendix VII for indicative '*consideration*' ranking.

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[1] AssiDomän (1996), Annual Report

⇒ ***AssiDomän - Stage Two: Manufacturing Factors Assessment Matrix for paper based packaging.*** See Table VII.1.3 in Appendix VII for indicative *'consideration'* ranking.

⇒ ***AssiDomän - Stage Three: Legal/Social Factors Assessment Matrix for paper based packaging.*** See Table VII.1.3 in Appendix VII for indicative *'consideration'* ranking.

⇒ ***AssiDomän - Stage Four: Performance Factors Assessment Matrix for paper based packaging.*** See Table VII.1.3 in Appendix VII for indicative *'consideration'* ranking.

Paper based packaging Life cycle stages

	Pre - Production	Production	Distribution	Use	After - Use	Disposal	Outputs *Summary*
Design Factors	◐	●	●	◒	◐	●	◔
Manufacturing Factors	●	●	●	◔ ●	◒	●	●
Legal/social Factors	◔	◔	●	●	◔ ●	●	●
Performance Factors	●	●	●	◔	◔	●	●

Table 8.13 AssiDomän Ecological Balance Sheet - *Summary matrix for paper based packaging*

AssiDomän - Ecological Balance Sheet Assessment Matrix for paper based packaging The output considerations ranking are for *'Design Factors'* is 75% positive consideration; for *'Manufacturing Factors'* 100% positive consideration; 'Legal/Social Factors' 100% positive consideration; and, 'Performance Factors' 100% positive consideration; As most of the summary ranking is 100% positive consideration the results scoring '12' Eco-Points See Table 8.13 for the *Ecological Balance Sheet.*

Case Studies Observations and Evaluation

The presented cases studies are examples aiming to demonstrate how the assessment matrix for paper based packaging works, how it is completed and how the is score awarded.

The way that the companies are selected for the case studies make them score highly. The reason is that the three selected companies were from those companies supplied environmental publications when conducted during the survey *'Environ Info System'* (see chapter 6.) and were those with immaculate quality or at least they did not present any

'negative' *(below standard, for example do not consider the environmental legislation for packaging or pollution standards)* environmental aspect of their operation.

In addition, the choice of the above three case studies was because these companies provided their environmental activities in more detail and that enabled the researcher to complete the matrices stages comprehensively. Therefore, the above case studies are examples of companies that their environmental commitments and activities are of a high degree of concern and as a result awarded the highest score. However it should be acknowledged that the case will be different for companies that they will not touch upon all those areas of environmental concern and they will score on the assessment matrix significantly lower.

8.5 Summary

This chapter has been examined and evaluates the possible option to be used as an extension in the use of the EMCS *model* for assessing the environmental performance of paper packaging products. This option is dealing with the formulation of an assessment matrix that examines four factors, these include: *Design factors, Manufacturing factors, Legal/Social factors and Performance factors* against packaging life cycle stages. The considerations on each factor summarised in the *Ecological Balance Sheet - summary matrix* and then translated into eco points with scoring between '1' for minimum to twelve '12' maximum environmental consideration. To demonstrate the applicability of the matrix three case studies were used as examples. Whilst support for the principle of a matrix tool emerged during the testing and evaluation of the new EMCS *model*, it is acknowledged that this tool has only the status of a concept and is not to be regarded as a principal component of the new thinking. Its' purpose is simply to show one way to take the EMCS *model* forward to implementation stage but it is for individual companies to interpret and develop the EMCS *model* for their needs.

In the next chapter the final appraisal of the research is presented along with recommendations for implementing further investigation based on the findings of the current research.

CHAPTER 9. CONCLUSIONS

9.1 Introduction

This last chapter summarises the main achievements of the research, provides a critical evaluation of the current research, and proposes ways to extend the findings from the existing work through further research.

9.2 Achievements

The achievements of the research are addressed in three areas: (1) designing environmental management systems related to and with effects on packaging design, (2) development considerations for environmental labelling and LCA, (3) development and implementation of an environmental analysis model for design and environmental managers.

The interpretation of these achievements followed a rigorous research process, which firstly examined the use of environmental information on packaging and methodologies used in awarding environmental credentials for products and packaging, i.e. life cycle analysis and assessment methodologies (see chapters 2 and 4). Secondly, it suggested alternative methods to eco-labelling for paper based packaging and brought up the need to differentiate products and packaging environmental impact through a system based approach (see chapter 4). Thirdly, five different models of environmental analysis, that encompass the recommendation made in the previous stage, were produced and tested (see chapter 5). Fourth, it investigated the current state of understanding on packaging businesses environmental philosophy, operation and control - *with regards to environmental management systems* - (see chapter 6). Fifth, based on the findings from the previous investigations, the recommended solution was produced, tested and modified, dealing with the development methodology for environmental monitoring, controlling and auditing packaging design activities in relation to company's environmental policy (see chapter 7). As an extension of the use of the recommended solution (model), this understanding was expanded into how this affected the design process for paper based packaging in assessing the different levels of environmental performance.

The main achievement of the research is the recommended solution in the form of Environmental Management Control System (EMCS) *model* that has been tested and modified (as outlined in 9.3).

The contribution of the model

The EMCS is a generic, theoretical, structural *model* for design managers and environmental managers for formulating, examining, monitoring and controlling environmental policy activities with regard to packaging design. The EMCS *model* simplifies the approach to auditing and controlling the environmental impact of paper based packaging products by providing clear step-by-step directions to be followed. To summarise, the contributions of the EMCS *model* are as follows:

⇒ The EMCS *model* is applicable for paper packaging companies in order to control and further reduce the environmental impact of their operation.

⇒ The *model* interpreted is a unique system that relates corporate environmental philosophy and design activities.

⇒ The *model* indicates the value of design at the centre of business activities.

⇒ The *model* provides clear, direct, step-by-step guidance on environmental analysis that are clear to design managers and environmental managers.

⇒ The *model* provides a feasible and precise framework that equips design managers and environmental managers with the knowledge to build the structure for companys' environmental initiatives.

⇒ The model works as an instructional reference for those conducting and evaluating environmental impact assessment for paper packaging products

⇒ The EMCS can be used by enterprises of any size. Preferably by big enterprises as they have greater human resources (specially trained staff such as environmental managers) and budgets available. However, the indications of environmental activities to be followed apply to smaller enterprises.

⇒ Each sub-model works in support of the main model. In addition, each sub-model has the potential to be used independently in order to examine particular aspects of companys' operation.

⇒ The EMCS is compatible with EMSs and in particular with the ISO 14001: 1996 on Environmental Management Systems.

The originality of the solution

The unique factor of the EMCS *model* is that it provides a methodology based on the philosophy of the EMSs (see chapter 2.) related to and translated into design. This approach gives an indication for companies to appreciate design as a profitable resource towards environmental achievements. The EMCS *model* defines the use of design as a corporate environmental mission and, not only helps packaging companies to comply with

current legislative and environmental trends but also assists them with forward planning on product development and innovation.

Assessment matrix the proposed extension in the use of the EMCS model

The assessment matrix for paper based packaging has been suggested as an extension in the use of the EMCS model to provide an indication in rating the environmental achievements of businesses that use the model. The assessment matrix for paper based packaging is a multi - consideration matrix as it deals with four factors (*Design Factors; Manufacturing Factors; Legal/social Factors and Performance Factors*) of environmental concern. The assessment matrix provides rating scales equivalent to Eco-points that differentiate the levels of environmental commitments.

Both the EMCS and the assessment matrix point out the crucial role of the design management in participating in business success towards environmental improvements.

Summary of achievements

To summarise, the research presented in this thesis has achieved the following:

1. It has proposed a framework for the development of a model of environmental analysis in relation to and with effects on packaging design. Moreover, it has confirmed the validity of the proposed framework through testing different formats of the models during the progress of the research by adopting a hard systems approach to the evaluation.
2. It offers an up-to-date view of environmental management and packaging design considerations. In addition it offers a set of empirical considerations for interpreting environmental management principles compatible with the packaging design process. In summary, the considerations are as follows: the prototype of different models that interpreted the relationship and compatibility of environmental management systems with packaging design; the potential of an assessment matrix in examining LCA methodologies for packaging; the use of a rating system as a part of the assessment matrix and the final EMCS *model* for paper packaging products.
3. It has developed a model (EMCS) for environmental analysis compatible with the packaging design process - which was the principal aim of the research.

9.3 Final appraisal

In the 1990s. environmental issues exert a far-reaching influence on the packaging business sector. New constraints on packaging products, manufacturers and business operation will be

imposed either by regulations to limit environmental damage and pollution, or by ensuring that market prices reflect the wider environmental costs of production. Business people should focus on a bigger picture defining their corporate structure and planning to respond to current and future environmental and market trends.

Packaging businesses should invest in design and development and integrate environmental management thinking and action plans for continuous environmental improvements. The environmental implications of business operations should be seen within the organisation extending to the global system, and the design role and implications should be part of that cross - cultural development.

It has been suggested by Welford et al., (1993) that there are two options for the environment, either to control your own destiny, or to have it controlled for you[1]. Legislation at present requires companies to address their environmental impact and to deal with their packaging waste. At present environmental management systems and eco-labelling are in voluntary basis but it may be regulatory or legislative in the future. Based on these recommendations companies should take their responsibilities in their own hands and be proactive and forward planning to control their own destiny. Strategies for marketing related to packaging, ecological auditing, EMS and LCAs must be at the core of any company that wants to be environmentally responsible, to comply with legislative/ regulatory frameworks and be profitable.

To access the environmental friendliness of paper packaging products a *system based approach* should be integrated. This study sees the 'system based approach' as a design management contribution to assessing the environmental impact and the design of products under the system that the organisation operates, related to its corporate mission, environmental policy and design policy. In addition, for packaging products environmental declaration efforts should be directed to monitoring the adoption of a 'cradle-to-grave' analysis and the process should be evaluated with regard to the system and the resources that the organisation operates.

It should be also considered that what could be the best environmental benefit for the production of paper packaging for one company may not be for another. That relates, for example, to the location of the company with regard to the reusability of the product; or

[1] Welford R, and Gouldson A, (1993) 'Environmental Management and Business Strategy', Pitman Publishing, UK, p 147

the establishment of recycling facilities; or the cost to obtain recycled fibres, like post-consumer waste;

This research project integrated environmental management thinking to design and by doing so it was necessary to investigate different inter-related areas as 'green' marketing and environmental claims, ecolabelling and LCAs, environmental aspects related with packaging design, environmental management systems and, ecological auditing and assessment methodology. The investigation directed in these areas aimed to produced a solution in integrating EMS thinking into packaging design development. A review of what the recommended solution achieved follows.

The development process of the new thinking

The formulation of the EMCS model addressed four research stages:

1st ***Formulation Stage:*** Review of the literature sources about LCAs methodologies, ecolabelling, green marketing, environmental product development (*Design for the Environment*-DfE); environmental management systems, and environmental issues related with paper based packaging. The literature review generated specific enquiries and a number of organisations were contacted (listed on the appendices IX.) aiming to accumulate up-to-date experience in the area and collect unpublished information and recommendations for inclusions in the development of the project (presented in chapter 2).

2nd ***Explanatory stage:*** At the *explanatory stage* Phase A. the first survey was conducted with the aim to cross reference findings from the above activities (for the analysis of the survey see chapter 4.2). Phase B. of the *explanatory stage* deals with two stages of interviews evaluating methodology for environmental labelling (stage one) and environmental auditing (stage two) with regard to paper packaging products (see 4.3 and 4.4). The evaluation of the findings from this stage generated different hypotheses to be examined in the next research stage and specifications to be included in prototyping different versions of models of environmental analysis (see 4.5).

3rd ***Investigation stage:*** At the *investigation stage* Phase A. five different formats of prototypes - *Environmental analysis models* - were formulated and tested with packaging companies and environmental organisations, the aim was to synthesised complex environmental issues to create a structural, fundamental model of practical value to environmental and design managers. In addition, the reason for formatting five different versions of the model was to assess and measure performance values between the different

prototypes in order to select the model with the most potential to be adopted by packaging business and explore it in detail at the next stage of the research (*testing and evaluation stage*). The findings from the evaluation (see chapter 5) of each format of the model tested, generated specifications and considerations for inclusion in prototyping the next format of the model and so on. The process of formatting the different prototypes was as follows:

- The first prototype format of the model constructed was based on the evaluation of the findings from the explanatory research stage (see chapter 4), the interrelation of the data and links hypothesised to exist were based on observations made in chapter 2.

- The second prototype format of the model anticipated recommendations made from the evaluation of the testing of the previous model. Such considerations were included as providing: more information about eco-design characteristics and requirements; more explanations and directions about legislative requirements affecting packaging production; more information about methodology in conducting an environmental impact assessment; and, attention directed in the use of more communicative and effective terminology.

- The third prototype format of the model, considered the following recommendations made from the evaluation of the testing of the second format of the model, include: the links restructured and simplified; the arrows replaced with directions in rows; and, the directions about how to proceed from one stage of environmental analysis to another planned to prioritise efficiently the activities to be followed.

- The fourth version of the model (*first format of the EMCS model*) considered the following recommendations made from the evaluation of the testing of the third format, such as: the structure of the model simplified by reducing the stages to be followed, and the amount of presented information reduced in order the model to be more communicative.

- For the fifth prototype format of the model the emphasis is directed to provoke the design approach to products environmental requirements. In particular, the intention for producing this format of the model was to generate design specifications to be included as a subsidiary model of the previous model for design considerations.

The evaluation of the testing of the five prototype formats of the model revealed that the EMCS model was the prototype with the most potential to be used in practical application, because it gives a good description of the stages of environmental analysis to be followed.

Prior to the development of the final model the second survey was conducted (*investigation stage* Phase B.) aiming to investigate current attitudes of environmental practising among paper packaging businesses and develop specifications for inclusion in the evolutionary prototyping of the model (see chapter 6). In particular the survey aimed to test theories related to environmental auditing methodology and to reveal new insights, knowledge and understanding about environmental activities and current practices in the packaging sector.

4th ***Testing and Evaluation Stage:*** The final stage of the research was the *testing and evaluation stage* where the recommended model (EMCS) from the previous stage of the research was developed in its final format based on hard systems thinking and according to

the evolutionary prototyping method. The findings and recommendations for improvements in the format of EMCS *model* made in the *investigation stage* were examined and evaluated in the *testing and evaluation stage* of the research in two phases. Phase A. evaluated the revised version of the EMCS (second format) that was designed based on the recommendations from the *investigation stage*. The evaluation of the findings from the testing at Phase A. were then encompassed in the third revised format of the model that was tested in Phase B. of the *testing and evaluation stage*. The evaluation of the findings from Phase B. produced the final model (see chapter 7.). The model presents a framework of considerations of environmental management principles and assessment methodology in relation to packaging. The research has taken a series of inherently complex issues, analysed them and synthesised them down to a fundamental, structural model of new thinking which is fully supported by the target audience.

Furthermore an extension of the use of the EMCS *model* is proposed by the use of an assessment matrix specifically designed to be adopted by paper packaging companies in order to measure and achieve environmental performance standards. Three vignette case studies were used to demonstrate the potential applicability of the matrix (chapter 8.).

The research methodology presented in Chapter 3. was followed step by step during the progress of the research, and where appropriate indicated in the other chapters.

At the end of each chapter a conclusion about the presented information is given. The most important of them are as follows:

⇒ the plethora of green claims on products make consumers sceptical and less receptive to green messages from companies,

⇒ environmental management could rectify this situation and change the image of 'green' products by using EMS and LCAs methodologies to control business activities and environmental products' development,

⇒ consumers need to have a clear image about business activities and be informed about product's adverse impact on the environment through on product information,

⇒ benchmarking, life-cycle analysis, ecolabelling, green accounting, reporting, and eco-audits are drivers to environmental improvements for products,

⇒ design management is a tool for companies to integrate, control and monitor products' environmental improvements,

⇒ to assess the environmental performance of paper packaging products a system based approach should be adopted,

⇒ environmental improvement at design level should be related to and reflect a company's environmental policy,
⇒ the strategic approach of design management can offer packaging products differentiation; market niches; innovation and creative products' performance towards environmental improvements;
⇒ the involvement of independent third parties/verifiers, environmental groups and international business standards organisations is the way forward for environmental management to be developed and give credibility to products and production methods

9.3.1 Evaluation of the research - Criticisms and Limitations

One criticism of the research presented in this thesis is that it could have included a large sample of subjects participating in the testing and formulating of the model from other EU countries. The main considerations for not doing so is not only in relation to the time limitation to complete the project neither the limited financial resources for Ph.D. research. However, the main reasons are based on the following considerations.

Firstly, the sample of UK packaging businesses interviewed is representative for the UK market (*see sections in each chapter which refer to interview participants selection*). Secondly, most of these companies were international or multinational and exported their goods or imported raw materials (such as recycled paper from Finland) to and from other countries so they were in the position to provide a complete picture of EU market requirements.

However, the most powerful reason is the example taken from the operation of the EU eco-labelling scheme to award the EU eco-label. Under the EU scheme the study undertaken for each product category can be led by the Commission or by a national competent body. Criteria proposed for a product group by a national competent body adopted after consultation with the Commission and applied in all the EU countries under the scheme.

A final criticism, is that the matrix system that is proposed as an extension of the EMCS model in awarding environmental credentials for paper packaging products required more development. It has been included only as an indicative way forward and should be regarded as a guide for future research. It should be noted that the intention of this study was to produce methodology for environmental analysis based on a hard system approach for environmental managers, environmental auditors and design managers to cope with conceptualisation of environmental orientated packaging development process compatible

with environmental management systems methodology that are preferred (compared with eco-labelling methods) by packaging businesses.

9.3.2 Further research - Extensions of Current Research

The issue of further research is twofold. First, it is concerned with elaboration of the existing research, and second with longer term research in order to extend the findings from the current research.

Extensions of Current Research

The EMCS *model* is a generic solution offered by the study. Therefore further research could be undertaken and some modifications could be made aiming:

⇒ to create standardised procedures for paper packaging products

⇒ to explore options for the Eco-points score to appear as a label on the packaging of the product. Such options include the following two suggestions:

1. The use of the oval symbol with negative printed in the middle the number of the Eco-points awarded accompanied with the wording *'Eco-points award'* or *'Environmental award'*. The number of eco-points awarded may have three formats:

   a) when the output considerations ranking is below 25% *Minimum Consideration* (see figure 8.16 Matrix Symbols) included, the oval symbol will appear in light grey with bold black typeface the number of the eco-points awarded, this apply from '1' to '4' eco-points,

   b) when the output considerations ranking is on the range of up to 50% *Adequate Consideration* the oval symbol will appear in dark grey with negative typefaces,

   c) negative typeface will also be used in the oval black symbol applies in the range of *Positive Consideration.* The use of colour in different scales of green instead of grey scale could be considered.

2. As the consumers will not be familiar with what eco-points mean and how they are related with the company's environmental activities and design, it is recommended in the beginning the above symbol accompanied with the summary matrix 'Ecological balance sheet'.

In addition if the matrix is going to be used by an accreditation body further work and exploration should be directed to identify the period of registration - use of the Eco-points - recommendation for two years of the use of the matrix is made (model periodically when required sub-model main model every three years). Also areas of weakness and areas of improvements should be developed more for inclusion in each factor of the matrices.

9.4 Summary

The final environmental analysis model is a generic solution offered by this research study, in managing and auditing packaging design activities in accordance with corporate environmental policy.

The findings from the current research and the formulation of the EMCS *model* have made a significant contribution to the area of environmental auditing and packaging design. The work has implications for the design of packaging and in the formulation of business environmental philosophy.

In addition, the EMCS model provides the framework for ecological analysis, that can be used by an accreditation/ verification body on environmental management systems, in order to explore options and establish standardization procedures for products and their packaging.

Finally, the main argument of this thesis is that the management of design process should be built to be compatible with the formulation of business environmental philosophy. The generic model offered by this study is a foundation for developing and understanding the links between organisational capabilities to manage their environmental performance and using design for competitive advantage.

Survey

July '95

The following questionnaire is aimed at all those who have relevant experience in the field of environmental management systems, in particular to senior executives, researchers and others interested in the packaging business sector.

Surname: .....

Job Title: .....

Business Activities: .....

Address: .....

..... Post Code : .....

Tel. : ..... Fax. : .....

Questions

1. Do you find the different environmental claims which appear on packaging 'misleading'?

Nearly Always ❑ 75% of the time ❑ 50% of the time ❑ 25% of the time ❑ Hardly Ever ❑

It would be helpful if you could provide an example and comment on it: .....

.....

2. Do you believe that the Eco-label award scheme will bring liability, in the market place for the product groups on which studies are undertaken?

Strongly believe ❑ Tend to believe ❑ Tend to disbelieve ❑ Disbelieve strongly ❑

3. Do you believe that packaging companies incorporate an environmental audit programme?

Nearly Always ❑ Often ❑ Seldom ❑ Hardly Ever ❑

In case you are involved in the production of packaging, please complete section four, otherwise go to question five.

4. A) Does your company hold an audit programme from the production stage through to disposal?

Nearly Always ❑ Often ❑ Seldom ❑ Hardly Ever ❑

4. B) Do you believe that the implementation of this audit is under proper control?

Nearly Always ❑ Often ❑ Seldom ❑ Hardly Ever ❑

5. Do you think that the development of specific criteria for Life Cycle Analysis and Eco-assessment as part of Eco-label scheme for paper packaging products will assist packaging business?

Strongly believe ❑ Tend to believe ❑ Tend to disbelieve ❑ Disbelieve strongly ❑

Thank you for your help.

Table I.1. Preliminary Survey - Business Activities of the participants

Value	Category *Business Activity of Corporation*	Score	Percentage
1	Professional Researchers	16	27%
2	Postgraduate Students	4	7%
3	Teaching in Design and Business Schools	18	29%
4	Environmental Consultancy	2	3%
5	Manufacturing Sector	10	17%
6	Service Sector	10	17%

Total sample: 60 respondents
Date of survey: *July and October 1995* **Date of Analysis:** *December 1995*

Table I.2. ***Statistics*** **Item 1. Do you find the different environmental claims which appear on packaging 'misleading'?**

Value	Label	Score	Percentage
1	Nearly Always	10	17%
2	75% of the time	28	46%
3	50% of the time	12	20%
4	25% of the time	6	10%
5	Hardly ever	0	0%
6	No reply	4	7%

Additional comments:

▷ The packaging often claims to be recyclable with no clue as to how to do it e.g. recyclable or say recyclable when it means made from recycled materials.

▷ When products e.g. washing powder claim not to contain a chemical which they never contained anyway. ▷ Too many to mention "biodegradable", "environmentally friendly" etc. very vague'

▷ Washing / cleaning materials. ▷ Use of Recycling logo to mean "Recyclable".

▷ Environmentally friendly - to Who/What/ What does it mean?

▷ Doesn't contain phosphates; - the product never did.

▷ Recycled paper is not always post consumer waste. The public don't understand this.

▷ Biodegradability never designed in time spans. ▷ I haven't noticed it.

▷ Highly visible - psychological techniques for displaying information - use percentage etc.

Table I.3. ***Statistics*** **Item 2. Do you believe that the Eco - label award scheme will bring liability, in the market place for the product groups on which studies are undertaken?**

Value	Label	Score	Percentage
1	Strongly believe	6	10%
2	Tend to believe	26	43%
3	Tend to disbelieve	22	37%
4	Disbelieve strongly	2	3%
5	No reply	4	7%

Table I.4. ***Statistics*** **Item 3. Do you believe that packaging companies incorporate an environmental audit programme?**

Value	Label	Score	Percentage
1	Nearly always	3	5%
2	Often	10	17%
3	Seldom	36	60%
4	Hardly ever	8	13%
5	No reply	3	5%

Table I.5. ***Statistics*** **Item 4 a) Does your company hold an audit programme from the production stage through to disposal?**

Value	Label	Score	Percentage
1	Nearly always	4	7%
2	Often	4	7%
3	Seldom	9	15%
4	Hardly ever	16	27%
5	No reply	27	45%

Table I.6. ***Statistics*** **Item 4 b) Do you believe that the implementation of this audit is under proper control?**

Value	Label	Score	Percentage
1	Nearly always	2	3%
2	Often	6	10%
3	Seldom	6	10%
4	Hardly ever	20	33%
5	No reply	26	43%

Table I.7. ***Statistics*** **Item 5. Do you think that the development of specific criteria for Life Cycle Analysis and Eco-assessment in the part of Eco-label scheme for paper packaging products will assist packaging business?**

Value	Label	Score	Percentage
1	Strongly believe	9	15%
2	Tend to believe	39	65%
3	Tend to disbelieve	4	7%
4	Disbelieve strongly	0	0%
5	No reply	8	13%

Additional comments:

▷ Tend to agree, only if simplified to be quick and effective to use.

▷ *tend to agree* - LCA in order to indicate areas of environmental impact but have doubts about the usefulness of a very in-depth LCA for 'visual' people like designers. Good to indicate particular strategy for company.

Table I. 8. Preliminary Survey Data Results

Candidate	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Category	4	1	3	3	6	1	3	3	5	2	3	3	3	5	2	3	3	4	2	1	1
Item 1.	2	2	2	2	4	3	3	3	2	2	2	6	1	2	4	1	3	2	2	2	2
Item 2.	1	2	2	2	3	3	2	2	3	3	2	5	4	2	2	3	2	1	2	3	2
Item 3.	3	3	4	2	4	3	2	3	3	2	3	5	3	3	2	3	3	3	3	3	3
Item 4 a)	4	5	4	1	4	5	2	5	3	3	5	5	5	5	5	5	5	4	5	4	5
Item 4 b)	4	5	4	1	4	5	2	5	3	3	5	5	5	5	2	5	5	4	5	4	5
Item 5.	1	2	3	1	2	2	2	2	2	2	1	5	5	2	2	3	2	1	2	2	2

Candidate	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
Category	1	3	1	3	3	6	2	1	5	3	1	6	5	6	1	6	3	5	3
Item 1.	3	3	2	4	6	2	4	2	1	2	2	1	2	1	4	1	6	1	1
Item 2.	2	3	2	2	5	3	3	3	1	2	2	1	2	1	3	3	3	1	5
Item 3.	3	3	3	2	5	3	1	3	1	2	2	2	3	2	4	5	3	3	3
Item 4 a)	5	5	5	1	5	5	2	4	1	3	3	2	3	3	4	5	5	3	5
Item 4 b)	5	5	5	1	5	5	4	4	2	3	3	2	4	4	4	5	5	4	5
Item 5.	2	2	2	1	2	3	1	2	1	2	2	1	2	1	2	2	5	2	5

Candidate	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	52	52	54	55	56	57	58	59	60
Category	1	5	3	5	1	6	5	1	6	3	6	4	1	1	3	1	1	6	6	5
Item 1.	4	2	6	2	2	3	2	2	3	2	3	2	2	3	3	2	3	2	2	1
Item 2.	3	2	5	2	2	3	4	3	2	2	3	3	2	3	3	2	3	2	2	1
Item 3.	3	3	3	3	3	4	3	3	3	3	4	4	3	4	3	3	2	3	3	1
Item 4 a)	5	4	5	4	4	5	4	5	3	4	5	5	3	4	5	4	4	4	2	1
Item 4 b)	5	4	5	4	4	5	4	5	3	5	5	4	3	4	5	4	4	4	2	2
Item 5.	2	2	5	2	2	2	2	2	2	2	2	5	3	5	2	2	5	2	2	1

Table I.9. Pearson's correlation coefficient between data sets for category and different items

	Category	Item 1.	Item 2.	Item 3.	Item 4a)	Item 4b)	Item 5.
Category	1						
Item 1.	- 0.12111	1					
Item 2.	- 0.12399	0.380246	1				
Item 3.	0.093038	0.174825	0.501439	1			
Item 4a)	- 0.20574	0.24109	0.475768	0.641158	1		
Item 4b)	- 0.16004	0.166667	0.438313	0.575909	0.881392	1	
Item 5.	- 0.12965	0.336933	0.620417	0.358527	0.427575	0.345038	1

Preliminary Study Interviews Checklist

The phase B. at the preliminary study are interviewees associated with packaging companies. Those interviews were conducted in two stages, investigating the following:

⇒ <u>FIRST STAGE</u> Interview aim: ***evaluating methodology for environmental labelling with regards to paper packaging products.***

⇒ <u>SECOND STAGE</u> Interview aim: ***evaluating methodology for environmental auditing with regards to paper packaging products.***

For both stages above the *interview schedule* devised in three sections.

- SECTION 1. **Introduction**
- SECTION 2. **Personal Details**
- SECTION 3. **Interview questionnaire** ***differs for*** <u>**FIRST STAGE**</u> **+** <u>**SECOND STAGE**</u>

The first two sections are common for the two stages of interviews the third section differs based on the aim of the interview.

<u>SECTION 1.</u> **Introduction** At the beginning I introduced myself and described what the Ph.D. research project was about. Then explained the reasons of the interview and emphasised how helpful it will be for the progress of the research to have the opinions of subjects'. It also explained - in particular at telephone interviews- that if at any moment the interviewer feels uncomfortable with the questionnaire and the time available to complete the interview he can skip any item of the questionnaire or terminate the interview. To make the interviewee feel comfortable was promised that confidentiality will kept and that the information provided will be used for academic purposes. To motivate the interviewers to participate. I promised to let them know about the research outcomes if it is of interest to them.

<u>SECTION 2.</u> **Personal Details** - ***Confidential***

Name: .....
Occupation: .....
Address: .....
Tel.:..... Fax.:..... E-mail:.....

Business activity
❑ Design Consultancy Packaging ❑ Environmental Consultancy Packaging ❑ Paper & board supplier
❑ Paper & packing manufacturer ❑ Packaging Retailer/ contract manufacturer

For statistical purpose could you please let me know some information about your company.

Number of employees
❑ 1-49 ❑ 50-99 ❑ 100-249 ❑ 250-499 ❑ 500-1000 ❑ 1000+ ❑ No answer (include: Do not know)

Turnover
❑ Under £1 million ❑ £1-£5 million ❑ £6-£10 million ❑ £11-£25 million
❑ £26-£50 million ❑ £51-£100 million ❑ Over £100 million ❑ No answer *(i.e. Do not know; or Cannot say;)*

SECTION 3. **FIRST STAGE** ***Evaluating methodology for environmental labelling with regards to paper packaging products***

1) Do you have an environmental policy?
❑ Yes ❑ No ❑ Not sure/ Not always

2) Do you market your products through 'green labelling'?
❑ Always (Go to 2a.) ❑ Some of the products (Go to 2a.) ❑ Never ❑ Unsure

2 a) *If you use an environmental claim on your packaging product:* What type of logo/label you are using? and, How do you obtain/award the label? .....

.....

3) Do you find the different environmental claims which appear on packaging misleading?
❑ Always ❑ Most of the time/Often ❑ Never ❑ Do not know/ Can not say.

.....

4) Do you believe that the different manufacturers claims for environmentally acceptable products are difficult to evaluate and compare?
❑ Yes (Go to 5.) ❑ Not sure ❑ No ❑ Do not know (Go to 6.)

.....

5) *If you agree with the above statement*, could you please state reasons or/and cases in support of the argument that environmental claims on products and packaging are difficult to evaluate and compare.

.....

6) The aim of the eco-labelling award schemes is to give a 'seal of approval' for products that are less harmful to the environment than other products in their class. Do you believe that the eco-labels award schemes bring liability in the market place for the product groups on which studies are undertaken?
❑ Always ❑ Most of the time ❑ Never ❑ Do not know

.....

7) *How do you see the role of EC Eco-labelling regulations (1992).* - Do you believe that the EC eco-labelling scheme is a useful marketing tool that helps manufacturers and retailers to promote products with minimum environmental impact among EU market?

.....

.....

8) Do you think that the EU Eco-label is appropriate for paper based packaging products?
❑ Yes (Go to 9.) ❑ No (Go to 8a.) ❑ Not sure (Go to 8a.)

.....

.....

8a) If the answer is negative or uncertain - Could you please suggest an alternative for environmental awarding of paper based packaging?.....

.....

.....

9) If you feel that you would like to add any comment in relation to the interview or about the research project it will be very welcome.

.....

Thank you very much for your time and help.

SECTION 3. **SECOND STAGE** ***Evaluating methodology for environmental auditing with regards to paper packaging products***

1) Do you believe that UK packaging companies are aware of environmental issues affecting their production?

❑ Always (Go to 1a.) ❑ Most of the time (Go to 1a.) ❑ No (Go to 2.) ❑ Not sure (Go to 2.)

1 a) If the answer is positive, please indicate what are the major environmental concerns for todays' paper packaging businesses? .....

.....

2) Do you believe that packaging companies identify the need to address the environmental friendliness of their products on a 'cradle-to-grave' basis? ❑ Yes ❑ No ❑ Not sure

3) Do you believe that the plethora of different environmental claims on packaging for products with minimum environmental impact are difficult to evaluate and compare?

❑ Yes ❑ No ❑ Not sure ❑ Do not know

.....

4) Do you find it appropriate for packaging products to be awarded with a single attribution label for each environmental merit for example one label for packagings' recycling context and another for the efficient use of energy during manufacturing on a scale from one minimum to ten maximum?

❑ Yes ❑ No ❑ No preference/ Do not know ❑ Other

5) Do you find it appropriate for packaging products to be awarded a label that addresses the environmental impact of the product in all life-cycle stages (using LCA methodology) on a scale of importance that differentiate products environmental impact starts from zero equivalent to *'non-green'* products' for products that are not considered of any environmental impact areas during LCA stages to *'dark-green'* applying to products that considered every single aspect of their LCA stages?

❑ Yes ❑ No preference ❑ No ❑ Other

6) Do you find it appropriate for packaging products to carry an environmental award (label) that applies on considerations about products' environmental impact in relation with and with effects about companys' environmental profile - companys environmental policy and activities?

❑ Yes ❑ No preference/ Do not know ❑ No ❑ Other

7) Do you believe that when a packaging product carries an environmental award (label) for its environmental qualities in conjunction with companys' environmental activities, it should be as a result of environmental auditing methodology?

.....

8) Do you believe that UK packaging companies incorporate an environmental audit programme review?

❑ Yes (Go to 8a.) ❑ No (Go to 9.) ❑ Not sure (Go to 9.) ❑ Do not know (Go to 9.)

8a) *If the answer is positive* - Could you please give information about what the audit involves?

.....

.....

9) If you feel that you want to make any suggestion or offer any comment in relation to the current state of environmental auditing and LCA with regards to paper packaging products, please do so?

.....

.....

.....

Thank you very much for your time and help.

Preliminary Study Interviews Content analysis

The total number of interviews in this stage were 201 of those 187 were contacted by phone, and 14 face-to-face. For the analysis most of the interviews were tape recorded and/or hand notes kept during the session by the researcher. The first stage of interviews collected opinions from 70 companies out of the total of 130 contacted, at the second stage 250 companies contacted and 117 responded to be interviewed. Face-to-face interviews interviewers asked the questions on both stages. The period of the interviews were over four months from November 1995 to February 1996.

For the purpose of contents analysis the subjects' respondents from the first round of interviews stage one has been classified as 'A' before the numerical value respond to the number of candidates, the candidates in the second stage have been classified 'B' and from face-to-face interviews classified as 'C'.

- A applies to 70 subjects respondents from the *first stage* of interviews.
- B applies to 117 subjects respondents from the *second stage* of interviews.
- C applies to 14 subjects respondents from both *first + second stages* of interviews.

Table II.1.: First Stage Interviews analysis - Demographics of the Subjects
FIRST STAGE Environmental labelling with regards to paper packaging products

Candidate - Occupation		Geographical area	Business activity	Number of employee	Turnover
A1.	Director of Design	Staffordshire	Paper/Board Suppliers	1-49	£6-£10 million
A2.	Manager/Design	London	Paper/Board Suppliers	No answer	£1-£5 million
A3.	Design Manager	Kent	Paper/Board Suppliers	50-99	£6-£10 million
A4	Packaging Designer	Northampton	Paper/Board Suppliers	100-249	£51-£100 million
A5.	Managing Director	Berkshire	Paper/Board Suppliers	1000+	Over £100 million
A6.	Quality Assurance Officer	Halifax	Paper/Board Suppliers	50-99	£6-£10 million
A7.	Managing Director	Hertz	Paper/Board Suppliers	50-99	£6-£10 million
A8.	Quality Assurance Manager	North Yorkshire	Paper/Board Suppliers	No answer	£6-£10 million
A9.	Customer Service Manager	Lancashire	Paper/Board Suppliers	1-49	£1-£5 million
A10.	Packaging Engineer	Gwent	Paper/Board Suppliers	100-249	£51-£100 million
A11.	Sales & Marketing Director	Kent	Paper/Board Suppliers	250-499	£51-£100 million
A12.	Packaging Buyer	Lancashire	Paper/Board Suppliers	50-99	£51-£100 million
A13.	Director Environm. Affairs	Lancs.	Paper/Board Suppliers	50-99	£6-£10 million
A14.	Packaging Engineer	Lancs.	Paper/Board Suppliers	250-499	£51-£100 million
A15.	Marketing Manager	Lancs.	Paper/Board Suppliers	50-99	£6-£10 million
A16.	Quality Assurance Supervisor	Lincs.	Paper/Board Suppliers	50-99	£6-£10 million
A17.	Product Area Manager	North Yorkshire	Paper/Board Suppliers	50-99	£6-£10 million
A18.	Mill Manager	North Yorkshire	Paper/Board Suppliers	1-49	£6-£10 million
A19.	Project Manager	Manchester	Paper/Board Suppliers	50-99	£6-£10 million
A20.	Commercial Manager	Gloucestershire	Paper/Board Suppliers	50-99	£6-£10 million
A21.	Senior Packaging Technologist	Nottingham	Paper/Board Suppliers	100-249	£51-£100 million
A22.	National Account Manager	Berks.	Paper/Board Suppliers	1-49	£6-£10 million
A23.	Packag. Technologist	Surrey	Paper products Manufact.	50-99	£51-£100 million
A24.	Packaging Specialist	London	Paper products Manufact.	100-249	£51-£100 million
A25.	Packaging Services Manager	Nottingham	Paper products Manufact.	50-99	£6-£10 million
A26.	Packaging Designer	Birmingham	Paper products Manufact.	50-99	£6-£10 million
A27.	Materials Development Officer	Hampshire	Paper products Manufact.	1-49	£6-£10 million
A28.	Production Manager	Cambridge	Paper products Manufact.	100-249	£51-£100 million
A29.	Account Manager	Manchester	Paper products Manufact.	50-99	£51-£100 million
A30.	Chief Designer	Hampshire	Paper products Manufact.	1-49	£6-£10 million
A31.	Design Manager	Birmingham	Paper products Manufact.	250-499	Over £100 mil.
A32.	Packaging Develop.	Swindon	Paper & packing Manufact.	50-99	£26-£50 million

A33.	Senior Graphic Controller	Middlesex	Paper & packing Manufact.	50-99	£11-£25 million
A34.	Packaging Designer	Middx	Paper & packing Manufact.	100-249	£51-£100 million
A35.	Assurance and Control Manager	Middx	Paper & packing Manufact.	50-99	£26-£50 million
A36.	European Packaging Manager	West Thurrock	Packaging Retailer	1-49	Over £100 mil.
A37.	Packaging Technologist	Nottingham	Packaging Retailer	50-99	£26-£50 million
A38.	Packing Manager	Middlesex	Packaging Retailer	50-99	£26-£50 million
A39.	Production Development Manager	Worcs.	Packaging Retailer *Contract Manufacturing*	50-99	£11-£25 million
A40.	Packaging Manager	South Yorkshire	Packaging Retailer	1000+	Over £100 mil.
A41.	Packaging Manager	Buckinghamshire	Packaging Retailer	100-249	£51-£100 million
A42.	Packaging Technician	Nottingham	Packaging Retailer	100-249	Over £100 mil.
A43.	Development Manager	Norfolk	Packaging Retailer	250-499	£26-£50 million
A44.	Packaging & Planning Services	London	Packaging Retailer	50-99	£26-£50 million
A45.	Group Project Leader	Nottingham	Packaging Retailer	50-99	Over £100 mil.
A46.	Global Packaging Controller	Middlesex	Packaging Retailer	100-249	£26-£50 million
A47.	Packaging Technologist	Surrey	Packaging Retailer	50-99	Over £100 mil.
A48.	Packaging Manager	Leeds	Packaging Retailer	50-99	£26-£50 million
A49.	Packaging Controller	Bedford	Packaging Retailer	100-249	£51-£100 million
A50.	European Packaging Development -Lead Engineer	Middlesex	Packaging Retailer *Contract Manufacturing*	50-99	£26-£50 million
A51.	Packaging Project Manager	East Surrey	Packaging Retailer	50-99	£51-£100 million
A52.	Head of Packaging	Surrey	Packaging Retailer	100-249	£26-£50 million
A53.	Graphics Development Manager	Manchester	Packaging Retailer	50-99	£11-£25 million
A54.	Packaging Development Manager	Manchester	Packaging Retailer *Contract Manufacturing*	50-99	£26-£50 million
A55.	Packaging Design Manager	West Yorkshire	Packaging Retailer	No answer	£6-£10 million
A56.	Packaging Co-ordinator	Hants	Packaging Retailer	50-99	£26-£50 million
A57.	Packaging Development Manager	London	Packaging Retailer *Contract Manufacturing*	50-99	£6-£10 million
A58.	Packaging Technologist	London	Packaging Retailer	250-499	£51-£100 million
A59.	Package Designer	Norfolk	Packaging Retailer	100-249	£26-£50 million
A60.	Packaging Co-ordinator	Cheshire	Packaging Retailer	No answer	£1-£5 million
A61.	Production Manager	Oxon.	Packaging Retailer	50-99	£11-£25 million
A62.	Packaging Technologist	Dorset	Packaging Retailer	No answer	£1-£5 million
A63.	Packaging Co-ordinator	Southampton	Packaging Retailer	50-99	£26-£50 million
A64.	Package Designer	Birmingham	Packaging Retailer	250-499	£51-£100 million
A65.	Package Designer	Somerset	Packaging Retailer	No answer	£6-£10 million
A66.	Design Consultant	Oxon.	Consultants Pack. Design	1-49	Under £1 million
A67.	European Packaging Director	Oxon.	Consultants Packag. Design	1-49	£1-£5 million
A68.	Principal Packaging Consultant	London	Consultants Packag.Design	1-49	£6-£10 million
A69.	Senior Project Manager	Milton Keynes	Consultants Packag.Design	1-49	£6-£10 million
A70.	Production Director	London	Consultants Packag. Design	1-49	Under £1 million

Occupation	**Geographical area**	**Business activity**	**Number of employees**	**Turnover**
Packaging Design = 34 **Packaging Engineer/ Technologist = 13** **Packaging Development Manager/ Director = 9** **Packaging Quality/ Assurance /Control Manager = 5** **Packaging Commercial Manager = 8** **Environmental Consultancy = 1**	**UK based sites**	**Paper/Board Suppliers= 22** **Paper products & packing Manufacturer = 13** **Packaging Retailer *Contract Manufacturing* = 29** **Consultants Packaging Design = 4**	**1-49 = 12** **50-99 = 32** **100-249 = 12** **250-499 = 6** **1000+ = 2** **No answer=6**	**Under £1 mil l. = 2** **£1-£5 million = 5** **£6-£10 mill. = 22** **£11-£25 milll. = 4** **£26-£50 mill. = 14** **£51-£100 mil. = 16** **Over £100 mil .= 7**

Table II.2.: Second Stage. Interviews analysis - Demographics of the Subjects
SECOND STAGE Environmental auditing with regards to paper packaging products

Candidate	- Occupation	Geographical area	Business activity	Number of employee	Turnover
B1.	Design Manager	Hants.	Consultants Packag. Design	1-49	£1-£5 million
B2.	Principal Consultant	London	Consultants Packag.Design	100-249	£51-£100 million
B3.	Print & Packaging Consultant	Durham	Consultants Packag.Design	100-249	£26-£50 million
B4	Packaging Consultant	Midlands	Consultants Packag.Design	50-99	£11-£25 million
B5.	Production Director	London	Consultants Package. Design	1-49	£11-£25 million
B6.	Packaging Consultant	Lincs.	Consultants Packag.Design	1-49	£11-£25 million
B7.	Company Director	Berkshire	Consultants Packag.Design	1-49	£1-£5 million
B8.	Associate Director	Cambridge	Consultants Packag.Design	50-99	£26-£50 million
B9.	Managing Director	Bristol	Consultants Packag.Design	1-49	£1-£5 million
B10.	Project Manager	Milton Keynes	Consultants Packag.Design	1-49	£6-£10 million
B11.	Packaging Consultant	Leicestershire	Consultants Packag.Design	1-49	£51-£100 mill.
B12.	Packaging Consultant	London	Consultants Packag.Design	100-249	Over £100 million
B13.	Packaging Consultant	Cambs.	Consultants Packag.Design	1-49	£11-£25 million
B14.	Packaging Consultant	Nottingham	Consultants Packag.Design	50-99	£51-£100 mill.
B15.	Packaging Consultant	London	Consultants Packag.Design	50-99	£11-£25 million
B16.	Principal Consultant	Surrey	Consultants Packag.Design	50-99	£6-£10 million
B17.	Design Manager	Berkshire	Consultants Packag.Design	1-49	£1-£5 million
B18.	Packaging Develop. Co-ordinator	Surrey	Consultants Packaging Design	50-99	£11-£25 million
B19.	Principal Consultant	Cheshire	Consultants Packag.Design	1-49	£6-£10 million
B20.	Production Supervisor	Somerset	Consultants Packaging Design	1-49	£1-£5 million
B21.	Consultant, Packaging & Print	Kent	Consultants Packaging Design	50-99	£26-£50 million
B22.	Principal Designer	London	Consultants Packag.Design	50-99	£26-£50 million
B23.	Head of Design	Surrey	Consultants Packag.Design	50-99	£11-£25 million
B24.	Production Manager	East Sussex	Consultants Packag.Design	No answer	£1-£5 million
B25.	Principal Consultant	Nottinghamshire	Consultants Packag Design	50-99	£11-£25 million
B26.	Packaging Projects Manager	Middlesex	Consultants Packaging Design	1-49	£6-£10 million
B27.	Packaging Consultant	Bucks	Consultants Packag.Design	1-49	Under £1 mill.
B28.	Packaging Systems Engineer	Oxford	Consultants Packaging Design	1-49	£6-£10 million
B29.	Packaging Consultant	Berkshire	Consultants Packag.Design	No answer	£1-£5 million
B30.	Packaging Consultant	Kent	Consultants Packag.Design	1-49	Under £1 mill.
B31.	Production Manager	Huddersfield	Consultants Packag.Design	50-99	£6-£10 million
B32.	Packaging Technologist	London	Environmental Consultants Packaging	50-99	No answer
B33.	Packaging Advisor	London	Environmental Consultants Packaging	100-249	£51-£100 mill.
B34.	Environmental Advisor	Hampshire	Paper Association	No answer	£1-£5 million
B35.	Pack. Environmental Advisor	Milton Keynes	Environmental Consultants Charity	50-99	£11-£25 million
B36.	Pack. Environmental Advisor	Kent	Environmental Consultants Charity	1-49	£1-£5 million
B37.	Head of Environm. Affairs	London	Packaging Retailer	100-249	£26-£50 million
B38.	Packaging Technician	Hertfordshire	Packaging Retailer	100-249	£51-£100 million
B39.	Packaging Designer	London	Packaging Retailer	1-49	£26-£50 million
B40.	Packaging Specialist	Leeds	Packaging Retailer	100-249	£51-£100 million
B41.	Chief Designer Packaging	Manchester	Packaging Retailer	No answer	£6-£10 million
B42.	Packaging Co-ordinatror	Kent	Packaging Retailer	No answer	£6-£10 million
B43.	Quality Manager	East Midlands	Packaging Retailer	50-99	£11-£25 million
B44.	Packaging Designer	Nottingham	Packaging Retailer	100-249	£26-£50 million
B45.	Design Manager	Kent	Packaging Retailer	100-249	£26-£50 million

B46.	Packaging Designer	Berkshire	Packaging Retailer	No answer	£11-£25 million
B47.	Packaging Engineer	Herts.	Packaging Retailer	1-49	£6-£10 million
B48.	Project Manager	Cheshire	Packaging Retailer	No answer	£1-£5 million
B49.	Marketing & Sales Director	Surrey	Packaging Retailer	50-99	£11-£25 million
B50.	Consultant Packag. Management	Cambridge	Packaging Retailer	100-249	£26-£50 million
B51.	Packag. Designer	Swindon	Toys Manufacturer	100-249	£26-£50 million
B52.	Pack. Development	Kent	Toys Manufacturer	1-49	£11-£25 million
B53.	Head of Manufacturing	Swindon	Toys Manufacturer *Pack.*	1-49	£11-£25 million
B54.	Senior Graphic Controller	Middlesex	Toys Manufacturer *Pack.*	50-99	£26-£50 million
B55.	Packaging Controller	Middx.	Toys Manufacturer *Pack.*	50-99	£26-£50 million
B56.	Product Manager	Surrey	Consumers Durables *Retailer Constructor*	No answer	£11-£25 million
B57.	Packag. and Point of Sale Executive	London	Consumers Durables *Retailer Constructor*	100-249	£26-£50 million
B58.	Packag. Design Engineer	Durham	Consumers Durables *Retailer Constructor*	250-499	£51-£100 million
B59.	Chief Designer	W Yorks.	Consumers Durables *Retailer*	100-249	£26-£50 million
B60.	Product Manager	Hampshire	Consumers Durables *Retailer Constructor*	100-249	£26-£50 million
B61.	Packag. Developm. Manager	Liverpool	Consumers Durables *Retailer Constructor*	100-249	£51-£100 mill.
B62.	Packaging Engineer	Northants	Mail Order *Packaging Manufacturer*	250-499	£26-£50 million
B63.	Materials Specification Manager	Northamptonshire	Mail Order *Packaging Manufacturer*	50-99	£11-£25 million
B64.	Group Packaging Leader	Lancashire	Mail Order *Packaging Manufacturer*	No answer	£11-£25 million
B65.	Packaging Manager	West Yorkshire	Mail Order *Packaging Manufacturer*	50-99	£11-£25 million
B66.	Packaging Specialist	Manchester	Mail Order *Packaging Manufacturer*	50-99	. £11-£25 million
B67.	Packaging Specialist	Middlesex	Mail Order *Packaging Manufacturer*	50-99	£11-£25 million
B68.	Developm. Manager	Newport	Pulp container converters	1-49	No answer
B69.	Group Project Leader	Bristol	Carton Converters	100-249	£26-£50 million
B70.	Packaging Manager	Lincs.	Carton Converters	1-49	£26-£50 million
B71.	Production Director	Leeds	Carton Converters	100-249	£6-£10 million
B72.	Pack. Consultant	Berkshire	Carton Converters	No answer	£1-£5 million
B73.	Systems Engineer	Kent	Carton Converters	100-249	£51-£100 mill.
B74.	Packag. Systems Consultant	Deeside	Carton Converters	50-99	£26-£50 million
B75.	Studio Manager	Leicestershire	Carton Converters	250-499	£51-£100 mill.
B76.	Quality Manager	Beds	Carton Converters	100-249	£26-£50 million
B77.	Design Manager	Hants	Case Converters	100-249	Over £100 mill.
B78.	Commercial Director	Cambs.	Case Converters	250-499	£51-£100 mill.
B79.	Chief Designer	Cambs.	Case Converters	1-49	£26-£50 mill.
B80.	Developm. Manager	Derbyshire	Case Converters	1000+	Over £100 mill.
B81.	Design Manager	Cambs.	Case Converters	50-99	£26-£50 mill.
B82.	Packaging Specialist	Oxford	Case Converters	100-249	Over £100 mill.
B83.	Customer Service Executive	Bristol	Case Converters	250-499	£26-£50 million
B84.	Operation Manager	S Humberside	Case Converters	50-99	£11-£25 million
B84.	Global packaging controller	West Yorkshire	General user company	100-249	£26-£50 million
B85.	Packaging and Planning Service	London	General user company	100-249	Over £100 mill.
B86.	Packaging Manager	Leeds	General user company	100-249	£26-£50 million
B87.	Artwork & Packag. Co-ordinator	Cheshire	General user company	50-99	£11-£25 million
B88.	Business Develop. Manager	Newport	Paper/board suppliers	250-499	£51-£100 mill.

B89.	Principal Paper Technologist	Hertfordshire	Paper/board suppliers	No answer	£6-£10 million
B90.	Senior Packaging Technologist	Nottingham	Paper/board suppliers	No answer	£11-£25 million
B91.	Commercial Manager	Gloucestershire	Paper/board suppliers	100-249	£26-£50 million
B92.	Quality Assurance Manager	Yorkshire	Paper/board suppliers	100-249	£51-£100 mill.
B93.	Director Environm. Affairs	Kent	Paper/board suppliers	100-249	No answer
B94.	Sales & Marketing Director	Lancashire	Paper/board suppliers	50-99	£6-£10 million
B95.	Director Environm. Affairs	Lancs.	Paper/board suppliers	250-499	£51-£100 mill.
B96.	Marketing Manager	Lancs.	Paper/board suppliers	100-249	£51-£100 mill.
B97.	Marketing Manager	Manchester	Paper/board suppliers	50-99	£26-£50 million
B98.	Exports Manager	Lancashire	Paper/board suppliers	100-249	No answer
B99.	Project Manager	Cheshire	Paper/board suppliers	250-499	£51-£100 mill.
B100.	Director Environm. Affairs	Cambs.	Paper & packing Manufact.	100-249	Over £100 mill.
B101.	Technical Manager	Surrey	Paper & packing Manufact.	50-99	£11-£25 million
B102.	Quality Assurance Manager	Essex	Paper & packing Manufact.	50-99	£11-£25 million
B103.	Packag. Technologist	Nottingham	Paper & packing Manufact.	100-249	Over £100 mill.
B104.	Packaging Designer	Nottingham	Paper & packing Manufact.	50-99	£26-£50 million
B105.	Head of Packaging Development	Northumberland	Paper & packing Manufact.	50-99	£26-£50 million
B106.	Technical Manager	Surrey	Paper & packing Manufact.	100-249	£51-£100 mill.
B107.	Package Developm. Engineer	Northampton	Paper & packing Manufact.	No answer	No answer
B107.	Packag. Technologist	Surrey	Paper & packing Manufact.	No answer	£26-£50 million
B108.	Quality Assurance Inspector	Northampton	Paper & packing Manufact.	50-99	£11-£25 million
B109.	Packag. Technologist	Surrey	Paper & packing Manufact.	100-249	Over £100 mill.
B110.	Packaging Designer	London	Paper & packing Manufact.	No answer	£6-£10 million
B111.	Materials Technology Manager	Hants	Paper & packing Manufact.	No answer	No answer
B112.	Packag. Specialist	Surrey	Paper & packing Manufact.	No answer	£11-£25 million
B113.	Pack. Co-ordinator	London	Paper & packing Manufact.	100-249	Over £100 mill.
B114.	Chief Designer	N. Humberside	Paper & packing Manufact.	50-99	£26-£50 million
B115.	Head of Design	Middlesex	Paper & packing Manufact.	250-499	£51-£100 mill.
B116.	Pack. Manager	Nottingham	Paper & packing Manufact.	No answer	No answer
B117.	Packag. Co-ordinator	Nottinghamshire	Paper & packing Manufact.	50-99	£26-£50 million

Occupation	**Geographical area**	**Business activity**	**Number of employees**	**Turnover**
Packaging Design/ Manager = 61 **Packagaging Engineer/ Technologist = 15** **Packaging Development Manager/ Director = 9** **Packaging Quality/ Assurance/ Control/Operation/ Manager = 8** **Packaging Marketing/ Commercial Manager = 8** **Packaging Environmental Affairs Director/Advisor = 10**	**UK based sites**	**Consultants Packaging Design = 33** **Environmental Consultants Packaging = 3** **Packaging Retailer *Contract Manufacturing* = 35** **Case/Cartons/Pulp Converters = 17** **Paper/board suppliers = 11** **Paper & packing Manufacturer = 18**	**1-49 = 23** **50-99 = 33** **100 - 249 = 33** **250-499 = 9** **1000+ = 1** **No answer (*Do not know*) = 18**	**Under £1 million = 2** **£1-£5 mill. = 11** **£6-£10 mill. = 13** **£11-£25 mil. = 27** **£26-£50 mil. = 32** **£51-£100 mil.=18** **Over £100 million = 7** **No answer = 7**

Table II.3.: First and Second Stage Interviews analysis - Demographics of the Subjects

Candidate	Occupation	Geographical area	Business activity	Number of employees	Turnover
C1.	Design Consultancy	Derby	Packaging Design	1-49	£6-£10 million
C2.	Head of Design	London	Packaging & Graphics	1-49	£6-£10 million
C3.	Environmental Advisor Packaging	Leicester	Environmental Consultancy - Charity	1-49	£1-£5 million
C4	Environmental Consultancy	East Midlands	Packaging Manufacturer	250-499	£26-£50 million

C5.	Head of Design	Leicester	Packaging Design	1-49	£1-£5 million
C6.	Prof. Researcher	Nottingham	Environmental Issues and Design	1-49	Under £1 million
C7.	Head Packaging Design	London	Research & Development Dept.	1-49	£26-£50 million
C8.	Environmental Advisor	London	Marketing & Promotion	50-99	£26-£50 million
C9.	Head of Design	London	Packaging & Graphics	1-49	£26-£50 million
C10.	Prof. Researcher	London	Research & Development Dept.	1-49	£6-£10 million
C11.	Prof. Researcher	Leicester	Design Research	1-49	Do not know
C12.	Environmental Advisor	London	Paper & packing Manufacturer	1-49	£6-£10 million
C13.	Design Consultancy	Leicester	Marketing & Promotion	1-49	£6-£10 million
C14.	Design Consultancy	Nottingham	Packaging Development	1-49	£6-£10 million
	Occupation	**Geographical area**	**Business activity**	**Number of employees**	**Turnover**
	Design Consultancy= 3 **Head of Design = 4** **Environ.Consultancy/ Environ. Advisor = 4** **Prof. Researcher = 3**	**London = 6** **Leicester/ East Midlands = 5** **Nottingham = 2** **Derby = 1**	**Packaging Design and Graphics = 5** **Packaging Marketing and Promotion = 2** **Packaging Research and Development = 5** **Paper and packing Manufacturer = 2**	**1-49 = 12** **50-99 = 1** **250-499 = 1**	**Under £1 million =1** **£1-£5 million = 2** **£6-£10 million = 6** **£26-£50 million = 4** **Do not know = 1**

Note: In the tables of content analysis the meaning of the symbols used are:

± for item of the questionnaire that not asked

\- for item of the questionnaire that not answered

\+ for item of the questionnaire that is not applicable for the potential responde

Table II.4.: Content Analysis of open-ended Items of First Stage of Interviews

FIRST STAGE Evaluating methodology for environmental labelling with regards to paper packaging products

1) Do you have an environmental policy?

2) Do you market your products through 'green labelling'?

2 a) ***If you use an environmental claim on your packaging product:*** **What type of logo/label you are using? and, How do you obtain/award the label?**

Candidate	**Item 1.**	**Item 2.**	**Item 2a.**
A1.	Yes	Yes	Use of paper recycling symbol accepted by the EU.
A2.	Most of the time.	Yes	Percentage of recycling content.
A3.	In most of the production lines.	Yes	Recycling symbols.
A4.	Yes	Yes	Sustainable Forest Management certification.
A5.	Yes	Yes	recycling logo
A6.	Always	Yes	Yes. Repak recycling symbol
A7.	Yes	Yes	Recycling/Recyclable logos
A8.	Yes	Yes	Recycling logo and litter logo -Tidy Britain Group
A9.	No	Do not know	±
A10.	Always	Yes	Paper recycling symbols.

A11.	Definitely	Yes	Recyclable/Recycling symbols.
A12.	Yes	Yes	Recyclable/Recycling symbols/ waste management certification
A13.	Always	a lot	Recovery, recycling symbols.
A14.	Hardly ever	Not to my knowledge	±
A15.	Frequently	for most of the products	a variety
A16.	Yes	Yes	recycling logos
A17.	often	Yes	Yes
A18.	Yes, always.	often	recycling/ recyclable logos
A19.	often	various	recyclable, recycling, percentage of recycling pulp.
A20.	always	always	forest certification, recycling percentage
A21.	Yes	for most of the product lines	recyclable, forest certification- waste management/ EMAS certification
A22.	Yes. based on the existing legislation	frequently	Waste management certification/ REPAK recycling logo
A23.	Hardly ever	sometimes	±
A24.	regularly	Not often	±
A25.	Definitely	Yes	paper recycling/recyclable logos
A26.	in general terms	depends	percentage of recycling paper/ recyclable/ tidy Britain group logo
A27.	Most of the time	Yes	Percentage of recycled paper/ biodegradable
A28.	Always	Yes	Recycling logos
A29.	Not very often	Do not know	±
A30.	Hardly ever	Not sure	±
A31.	Often	Yes	Recyclable, Recycled pulp content.
A32.	Always	Frequently	Waste management certification/ recycled content
A33.	Always	a variety	recyclable/ recycling/ litter
A34.	Not very often	Not sure	±
A35.	always for different production areas	A number of symbols.	Biodegradable/ REPAK recycling logo/ EU recovery, recycling symbols
A36.	Not sure	depends on product requirements	±
A37.	Always	Yes	EU recycling/recyclable logos plus own labels.
A38.	Hardly ever	a variety	Recyclable/ recycling and own labels.
A39.	Almost Never	Not sure.	±
A40.	Always	lots	biodegradable/ recyclable/ litter/ recycling content/ EMAS certification and waste management forest certification
A41.	Often	based on products requirements	own labels
A42.	Not sure	Probably.	±
A43.	Yes	a good number	Recycling/Recyclable/ Biodegradable
A44.	Not sure	I can not say.	±
A45.	Always	lots	Recyclable/Biodegradable/ recycled content - own label.
A46.	Yes	Of course.	German Green Dot. own labels
A47.	Yes, Always.	all	recycling/recyclable/biodegradable/un it-litter
A48.	Never	Not sure	±
A49.	Most of the time	Can not say.	±
A50.	Always	definitely	own labels - paper/board recycled content
A51.	Often	Depends on products	Own labels

		requirements.	
A52.	Yes, always.	Yes.	Recyclable/ recycling percentages/ recoverable.
A53.	Yes, to my knowledge.	often	Recycling/ biodegradable.
A54.	Often	probably	±
A55.	Never	No	±
A56.	Yes.	a variety	
A57.	Yes, always.	a number of logos	recyclable/ recycled content etc.
A58.	Often.	most of the time	own labels
A59.	Hardly ever	depends on products requirements	±
A60.	Yes, always.	often	
A61.	Most of the time.	Yes	Own labels . Packaging recycled content
A62.	Hardly ever.	sometimes	±
A63.	Most of the times.	a number of labels	Recycled/biodegradable/ management forest
A64.	in most occasions	Yes.	recyclable/recycling/litter
A65.	Always	often	recycling
A66.	Sometimes	based on clients requirements	
A67.	Yes, speaking on behalf of my clients	Yes	Green Dot. REPAK recycling symbol. Recyclable/recycling/recoverable recommended by the EU Packaging & Packaging Waste Directive
A68.	Most of the time.	yes	percentage of recycled pulp
A69.	Often.	most of the time	recycling/ recyclable
A70.	Hardly ever.	frequently	reusable/recycling/recoverable packaging.
C1.	Often	based on the given brief from the client	recycled content usually
C2.	Always	varies dependent on the client	Manufacturer/Retailer own label e.g. Sainsbury's/ Recycled content/ packaging recyclability. German Green Dot.
C3.	Yes.	+	+
C4	Always	Yes	Recycling logos/ management forest label.
C5.	Sometimes	yes	recycling symbols
C6.	Yes	+	+
C7.	Yes from 1972	always	Recommended logos/labels e.g. EU recycling logo
C8.	Yes.	frequently	percentage of recycled paper/ retailers own labels
C9.	Most of the time	whatever the customer wants	retailers environmental labels/ recycled paper content
C10.	Yes.	+	+
C11.	Yes fundamentally	+	+
C12.	Always	yes	percentage recycled content/ sustainable management forest/ biodegradable/recyclable
C13.	Often.	yes	percentage of recycled paper
C14.	The majority of the companies.	most of the time	recycled/ recyclable

Item 1.		Item 2.		Item 2a) Frequency of similar words/phrases	
Always	43	Always	37	Recycling symbol EU/ Repak /Percentage of recycled pulp - *post consumer waste.*	57
Most of the time/ Often	26	Most of the time/ *For most of the product*	31	Recyclable symbol EU Directive on Packaging and Packaging Waste	24
Hardly ever	9	Hardly ever	2	Manufacturer , Retailer own label	11
Never	3	Never	2	Biodegradable	9
No preference. *Not sure*	3	No preference. Do *not know.*	8	Management forest Certificate	7
		Not applicable	4	Other. *Include: Yes, but not stated/ Waste management, EMAS certification*	7
				Litter logo - Britain Tidy Group	6
				Recovery. Recoverable symbol	5
				Green Dot eco-label	4
				Reusable EU	1

3) Do you find the different environmental claims which appear on packaging misleading?

4) Do you believe that the different manufacturers claims for environmentally acceptable products are difficult to evaluate and compare?

5) If you agree with the above statement, could you please state reasons or/and cases in support of the argument that environmental claims on products and packaging are difficult to evaluate and compare.

Candidate	Item 3.	Item 4.	Item 5.
A1.	Most of the time as consumer are not always aware about the meaning of different labels.	Most probably.	Because, there is not a common standardisation system in place.
A2.	Can not say.		±
A3.	Probably, there are so many different environmental claims on products.	Yes.	LCA methodology is not standardised.
A4.	Definitely, need more work to be done about environmental. labelling.	Yes.	There are so many labelling systems and environmental symbols.
A5.	Very often, so many vague claims are made.	Yes.	There is not a common standardisation system.
A6.	Nearly always, more attention is required.	Probably.	There is not a clear methodology to follow.
A7.	Very often, a common standardisation system will be very desirable.	Definitely impossible to compare them.	There are so many different international and assorted manufacturers claims that are difficult to compare.
A8.	Yes, claims are not always be able to substantiated them.	Yes.	there are so many claims
A9.	Quite often. - for example about biodegradability.	Yes, very complicated.	For example LCA methodology.
A10.	Yes. for example recyclable and recycled might perceived the same by the consumers.	Yes, more comparisons are required	A standardised rating scale of one to ten would make the difference.
A11.	It might happening. Environmental claims need better controlling.	Not sure.	±
A12.	Yes. There are cases that claims used unnecessary for example there is no meaning behind the words 'environmental friendly' - the environmental merit of the product should clearly stated.	Yes.	Sometimes companies place on packaging environmental claims that apply in the companys' environmental policy and are not related with the product.
A13.	Definitely, there are cases that claims are used without any technical/ legislative backing.	Yes.	More legislation is required - for what it should be used and what it should be avoided.
A14.	I can not really say.	Perhaps.	±

A15.	Yes, so many environmental claims are made that is difficult to see the wood fro the trees	Definitely.	A standardised system should be recommended.
A16.	Very often. There are so many different wordings that claim the same thing.	Yes.	A code of practice is required.
A17.	Yes. There are a lot of complains on the press.	Yes.	There are companies that used mill broke and state that percentage as post -consumer waste. LCA methodologies should be explored.
A18.	Maybe. There are so many different environmental claims saying the same thing e.g. retailers labels	Yes.	Difficult to evaluate and compare. I have to do some recommendations for client and I found difficult to collect information. Development of Life cycle analysis and Life cycle inventory methodologies.
A19.	I haven't notice.		±
A20.	Yes. There are lots of cases of consumers miss-information.	Yes.	Environmental claims need mandatory control.
A21.	Quite often - there are so many different claims that do not have any reason for existence e.g. ozone friendly, CFC free etc.	Yes.	More comparisons and specifications are required.
A22.	Quite possible. So many claims in existence.	Yes.	For the same reason I already said.
A23.	Yes. a better classification system is required.	Yes.	probably differentiation of products with different environmental impacts on a scale of importance.
A24.	Probably. There are a number of complains made for example lightweight - without enough specifications	Yes.	LCA and assessment methodologies should be developed.
A25.	Definitely. e.g. 'environmental friendly pulp' - so what does it means?	Yes, I found it difficult,	
A26.	Probably. Environmental information are not always visible for consumers.		±
A27.	Probably.	Most probably.	±
A28.	Maybe the use of different wordings in the same packaging that are claiming the same thing.	Yes.	Investment in product differentiation and LCAs required.
A29.	I haven't noticed.		±
A30.	Yes. In cases that environmental claims are used as a marketing tool without any really benefits on the environment, e.g. environmental friendly; green; caring for the environment; designed for a better environment;	Yes. I found it complicate myself.	The EU ecolabelling scheme is of some way off, but a standardised labelling system is required. Such system should be easily understood by consumers.
A31.	Probably. Measurements need to be taken so misleading claims can be avoided.	Yes, as a result of so many claims about.	Clear information on the pack should be controlled.
A32.	Yes. A good example is a phosphate free claim by some washing-up liquids while not washing-up liquid contains phosphates.	Probably.	Some claims are difficult to evaluate and compare with the existing technology.
A33.	Yes. The use of so many logos and labels in a short space given.	Yes.	Visibility issues and wordings needed more control.
A34.	I am not aware.	I can not say.	±
A35.	It can be the claim 'biodegradable' as it needs more research on the material before freely used.	Yes.	Differentiation of products environmental impact should be emphasised.
A36.	Probably the case of multiply claims saying the same thing.	Yes.	More codes and information should provided.
A37.	Probably. Paper packaging products indicate together the percentage of pre and post-consumer waste used.	Yes very complicated.	Investment in environmental technology and management is going to change the situation.
A38.	Often. There is a lot of talk about consumer confusion with the wordings 'recyclable' and 'recycled' that are not synonymous.	Probably.	For example claims that imply more than it actually covers.
A39.	Yes. Maybe because there is not a common labelling system.	Yes.	More research needed.
A40.	Yes in some occasions - efforts need to be made by the producer to mean what it claims to be on the product.	Yes, in some respect.	I believe environmental labelling is in a developing stage and more works need to be done.

A41.	Probably about legibility issues.	Often.	
A42.	Yes. As companies telling what consumers want to listen and not what the product it really is.	Yes.	For example, 'this product uses less electricity' or less energy but, without mentioned the percentage of less energy used than the previous model.
A43.	Occasionally - mainly because most companies do not follow the same labelling system.	Yes.	So many retailers labels.
A44.	Probably.	I feel this should be the case.	
A45.	In some occasions where assumptions about the real environmental benefit can be questioned, e.g. ozone safe	Yes.	Labels should use a rating system to award products' environmental benefits.
A46.	Yes. there are complains from consumers in Europe.	Definitely.	Standards and marketing codes of practice should be available.
A47.	Environmental claims about materials, recycled content should be very precise and honest.	Yes.	More precise labelling system is required.
A48.	Maybe.	Most probably.	±
A49.	Perhaps in cases that claims can not be easily justifiable.	Yes.	
A50.	Often, as environmental claims are not mandatory legislative.	Yes.	Legislative backing is required.
A51.	Probably - consumers needs to be more educated on environmental and ethical issues.	Probably.	More information is required.
A52.	Yes. as some products claim environmental benefits that are not exist.	Yes.	Environmental claims should be simplified and standardised.
A53.	Often. attention needs to be given in the use of environmental claims.	Yes.	It is interesting how many different manufacturers' claims claim the same thing.
A54.	Definitely. There are occasions that environmental claims appear to be woolly, vague and meaningful.	No doubt.	More control over environmental claims is essential.
A55.	Sometimes, I believe.	I presume.	
A56.	Most of the time, there is a lot of confusion in the paper industry about the use of environmental claims.	Yes, there is a confusion.	Probably because of the absence of comparisons and evaluation of on products environmental information.
A57.	Yes. The existing environmental claims are not good enough to differentiate products environmental qualities, that's why retailers use their own labels.	Unquestionably	Attention should be given to alternatives approaches to eco-labelling. For example the development of rating scales.
A58.	I believe there are cases of products miss-information.	Most likely.	
A59.	Yes, sorry I can not recall at the moment.	I tend to believe.	±
A60.	Yes, there are cases of overwhelming consumers with green messages that ends to be confusing.	Yes.	More information should be provided for consumers and users.
A61.	Yes, with so many environmental labels/symbols for the same reasons it is confusing.	Sure.	Legislation should be in place.
A62.	Most of the time, as environmental claims are not mandatory controlled.	Yes.	Apparently LCA and assessment methodologies should developed in support of labelling schemes.
A63.	Yes, there are cases of excessive, multiple or meaningless claims.	Yes to my understanding	Clear specifications are essential.
A64.	Frequently. e.g. 'environmental friendly'	Presumable.	
A65.	Probably.	I assume so.	±
A66.	Yes, for example 'ozone friendly', recycled when it means recyclable.	I believe so.	More technical standards.
A67.	Yes, as retailers introduced their own labels and there is not any legal bounding.	Yes.	More mandatory control should be in place.
A68.	Yes, with so many logos in place.	yes	It should be one system in place.
A69.	Yes, because of unethical market competition.	Yes.	Product should promoted on an ethical base.
A70.	Yes, environmental information are not displayed properly on the pack. Logos or	Yes,	more guidelines and codes or practice required

	wordings can be illegible, repetitive etc.		
C1.	Often as some environmental claims are difficult to substantiated.	Yes.	Assessment methodologies need to be explored.
C2.	Yes, Supermarkets overload products with unreliable environmental claims e.g. the outer carton in which toothpaste tubes sold is complete unnecessary but the product claims to be environmental friendly;	Yes	Claims that imply more that it actually covers.
C3.	Definitely. There is not a common accepted code of practice for awarding environmental credentials on packaging products.	Yes.	There is not always technical or legislative backing for claims that are made.
C4	Probably, manufacture claims whatever they want sometimes, only to make more sales.	Very likely.	Not norms, standards and specifications for the producer.
C5.	Yes, e.g. products carry the German Green Dot label and sold in the UK market where the label does not apply.	Yes.	There are not enough guidelines and specifications for the producer in the use of labelling.
C6.	Much environmental information is associated with spurious or inaccurate claims, e.g. as excessive, multiple or meaningless claims or claims which are not explained well	Yes.	More comparisons, LCAs and specifications should be in place.
C7.	Probably.	Quite possible.	±
C8.	Very often. Lots of meaningless claims.	Yes.	More control over them.
C9.	Yes. Recycling and recyclable are not synonymous as people tend to believe.	probably.	LCA and ecological assessment are in a developing stage.
C10.	Yes Today consumer exploited through miss-perception of environmental information on packaging.	Yes,	that's why there are so many misleading claims. More specification and control - misleading claims should be bound.
C11.	Yes. Companies exploiting consumer awareness and concerns over green issues by claiming environmental benefits on their products that are not exist.	Yes.	Better differentiation of products' impact, a use of rating scale or different point labels should be considered.
C12.	Yes, environmental information on products (packaging) are often unreliable and not always specific with regard to environmental claims that are made.	Yes very difficult.	However, specific guidelines are not provided, neither is a common standardisation system to specify and substantiate environmental claims for pulp paper and board packaging materials
C13.	Yes, e.g. ozone safe, CFC free outrageous	Yes	Environmental claims should provide information about the environmental factors that are considering.
C14.	Excessive claims are made to attract green consumers.	Possible.	±

Item 3.		**Item 4.**		**Item 5.**	**Frequency of similar words/phrases**
Always	43	Always	60	There is not a common Standardisation system. *More legislation required.*	20
Most of the time *Often./ Probably*	36	Most of the time *Often*	22	Codes of practice to be developed. *Include: Technological specifications, visibility, legibility issues and more information to be provided*	15
No preference *Do not know.*	5	No preference *Not sure*	2	There are not clear LCA and assessment methodologies.	12
				So many labelling systems - Confusing.	6
				A standardised rating scale *from one to ten* recommended./ *Differentiation of products environmental impact.*	7
				More research required investment in technology and management.	5
				Irrelevant, misleading, confusing environmental claims	5

6) The aim of the eco-labelling award schemes is to give a 'seal of approval' for products that are less harmful to the environment than other products in their class. Do you believe that the eco-labels award schemes bring liability in the market place for the product groups on which studies are undertaken?

7) How do you see the role of EC Eco-labelling regulations (1992). - Do you believe that the EC eco-labelling scheme is a useful marketing tool that helps manufacturers and retailers to promote products with minimum environmental impact among EU market?

Item 6. Frequency of similar words/phrases

Strongly believe	4
Tend to believe - *Probably*	31
Tend to disbelieve - *Not sure*	36
Disbelieve strongly	6
No preferences - *I do not know./ No answer*	7

Item 7. Frequency of similar words/phrases

Strongly believe	4
Tend to believe - *Probably*	22
Tend to disbelieve - *Not sure*	36
Disbelieve strongly	11
No preferences - *I do not know./ No answer*	11

8) Do you think that the EU Eco-label is appropriate for paper based packaging products?

8a) *If the answer is negative or uncertain* - Could you please suggest an alternative for environmental awarding of paper based packaging?

Item 8.

Yes	3
Probably- *Not sure.*	21
No	43
No preference *No answer./ Do not know*	17

Item 8a. Frequency of similar words/phrases

Single environmental attribution label. A label awarded for each area of environmental consideration of products' life-cycle e.g. use of energy; recycling content, packaging biodegradability; etc./ also called: Performance label. and, Packaging performance environmental values label.	14
Eco-rating system. A standardised rating system on a scale of one to ten. - Explained as a scale of importance that differentiate products environmental performance.	23
EMAS/ BS/ISO environmental certification. Environmental award for the product in relation to environmental management system and companys' environmental policy.	18
Other. One environmental label for the companys' performance and another for the product. + A different label for the manufacturing process and another for the material used. + A designer label for the construction of the packaging, easy assemble and disassemble, lightweight. + Establishment of a packaging body (private or governmental) that award and control manufacturers environmental labels - standardised packaging products environmental performance.	7
No preference. No suggestion/ Do not know./ No answer provided.	22

9) If you feel that you would like to add any comment in relation to the interview or about the research project it will be very welcome.

A1. Environmental labelling schemes should take more considerations of the design process and requirements.
A6. Environmental information on products needs to communicate clearly and efficiently the company's environmental values along with corollary benefits and basic product information.
A13. The preferences of packaging industry is towards the EMAS certification and not the use of eco-labelling. But, Environmental Management Systems assess the environmental performance of a company rather than the product and packaging. Typically, those companies certified or verified are allowed to use a logo on corporate publicity material but not on their products and packaging.

A21. EMS are a 'necessary' part of business activities towards good management and good housekeeping and are giving reputations and credibility in business environmental performance. Suppliers often demand EMAS certification. For that reason, packaging business are in support of Environmental Management Systems rather than labelling.
A36. Packaging companies are interested on EMAS certification because, EMAS is that, unlike eco-labelling, it considers different regulations and legislations and targets on environmental improvement.
A39. BS on environmental management systems and ISO on quality and environmental management should be explored by packaging business.
A46. For packaging products it should be merits in combining process and performance standards approaches in a labelling scheme.
A36. Environmental claims on packaging should be legal, truthful, honest, decent and relevant with existing environmental and recycling legislation.
C3. Manufacturers claims should not manipulate consumers by providing false and misleading claims.
C6. Guidance is urgently needed to control unverified environmental claims on packaging products.
C12. The use of environmental information on packaging should be honest and accurate, assisting consumers in their purchasing decisions and in support of the operation of recycling and reclamation facilities.

Table II. 5.: Content Analysis of open-ended Items of Second Stage of Interviews

SECOND STAGE Evaluating methodology for environmental auditing with regards to paper packaging products

1) Do you believe that UK packaging companies are aware of environmental issues affecting their production?

1a) If the answer is positive, please indicate what are the major environmental concerns for todays' paper packaging businesses?

Item 1. Frequency of similar words/phrases

Strongly believe	79
Tend to believe - *Most of the time*	36
Tend to disbelieve	4
Disbelieve strongly	12

Item 1a. Frequency of similar words/phrases

Environmental legislation. *EU Packaging and Packaging Waste Directive./ Air water and ground pollution/ Recycling, the legislative use of recycled fibres/ Waste minimisation/Suppliers legislation*	112
Producer obligations/ penalties. *Duty of Care obligation./Litter. Waste transportation penalties*	80
Codes of practice. *EMAS./ BS 7750./ ISO 9000, 14001*	76
Suppliers environmental audit. *Forestry certification*	76
Environmental Technology. *ECF, TCF and totally closed mills./ Materials innovation. Lightweight. Biodegradability*	45
Consumer demands pressures - *Green marketing*	34
Environmental profit. *Investment in clean technology*	27
Investors/Shareholders pressures - *Ethical investment/ responsibilities.*	14

2) Do you believe that packaging companies identify the need to address the environmental friendliness of their products on a 'cradle-to-grave' basis?

3) Do you believe that the plethora of different environmental claims on packaging for products with minimum environmental impact are difficult to evaluate and compare?

Item 2. Frequency of similar words/phrases

Strongly believe *Always*	24
Tend to believe *Most of the time. Often.*	17
Tend to disbelieve. *Not very often/ Hardly ever*	46
Disbelieve strongly *Never*	32
No preference - *Not sure./ Do not know./ I can not say.*	12

Item 3. Frequency of similar words/phrases

Strongly believe *Always*	92
Tend to believe *Most of the time. Often.*	29
Tend to disbelieve - *Hardly ever*	6
Disbelieve strongly *Never*	-
No preference - *Not sure./ Do not know./ I can not say.*	4

Comments:

B8. For the development of environmental labelling systems for paper packaging should be considered 'cradle-to-grave' analysis of products' life-cycle. In addition, feasibility studies that address a pragmatic approach to the comparison of environmental investment and cost benefit analysis.

B35. To evaluate the credibility of environmental claims need proper development and implementation of LCA and assessment methodologies for the design and production that qualified and quantified the inputs and the outputs on the system and effects on the environment.

B37. The disadvantage of the existing state of environmental labelling is that they provide criteria for products with minimum environmental impact without considering the impact of other products in the market that they have a reduced impact that those awarded the label.

B67. Corporations get competitive advantages by using an international label and system commonly accepted and recognised.

B82. LCAs and cradle-to-grave analysis should be used as tools in investing in future products innovation abilities.

B95. Research and development required in the area of LCA and cradle-to-grave analysis for future product innovation. Such products' may appear to carry exceptional or additional environmental benefits, outside the scope of ecolabelling.

4) Do you find it appropriate for packaging products to be awarded with a single attribution label for each environmental merit for example one label for packagings' recycling content and another for the efficient use of energy during manufacturing on a scale from one minimum to ten maximum?

5) Do you find it appropriate for packaging products to be awarded a label that addresses the environmental impact of the product in all life-cycle stages (using LCA methodology) on a scale of importance that differentiate products environmental impact starts from zero equivalent to *'non-green'* products' for products that are not considered any environmental impact areas during LCA stages to *'dark-green'* applying to products that considered every single aspect of their LCA stages?

6) Do you find it appropriate for packaging products to carry an environmental award (label) that applies on considerations about products' environmental impact in relation with and with effects about companys' environmental profile - companys environmental policy and activities?

Item 4. ***Frequency of similar words/phrases*** **Item 5.**

Agree Strongly	20
Tend to agree. *Possible*	27
Tend to disagree. *I found it complicated./ Not very clear./ Probably not.*	45
Disagree strongly *I found it very complicated./ Not easy to used.*	33
No preference *Do not know./ I can not say.*	6

Agree Strongly	37
Tend to agree. *Possible*	45
Tend to disagree *I found it complicated./ Not very clear./ Probably not.*	21
Disagree strongly *I found it very complicated./ Not easy to used.*	17
No preference *Do not know./ I can not say.*	11

Item 6.

Agree Strongly	48
Tend to agree. *Possible*	57
Tend to disagree *I found it complicated./ Probably not.*	19
Disagree strongly *I found it very complicated./ Not easy to used.*	-
No preference *Do not know./ I can not say.*	7

Other, alternatives suggested on environmental awarding of paper based packaging include:

- EMAS/ ISO certification.
- The use of LCA and impact assignment to be considered.
- Environmental cards.

> Forest certification.

7) Do you believe that when a packaging product carries an environmental award (label) for its environmental qualities in conjunction with companys' environmental activities, it should be as a result of environmental auditing methodology?

Item 7. - Frequency of similar words/phrases

Strongly believe *Definitely.*	34
Tend to believe *Most likely. I presume so..*	72
Tend to disbelieve. *Not very easy./ Hardly ever*	13
Disbelieve strongly *Never*	-
No preference - *Not sure./ Do not know..*	12

Comments:

> Yes, I found it very interesting.

> Not easily to achieve, the use ofenvironmental auditing methodology might be complicated.

> Yes, I think it is similar with what ISO 14001 trics to achicvc.

> Yes, this is a good approach to talk about environmental improvements.

> Yes, it gives another dimension in the application of environmental management systems for packaging business.

> Yes, but lots of considerations should take place about what the audit might involve; how it will be audited; monitored and controlled. It should be taken into account that every company is different in size, market position, production methods, and environmental performance.

> Probably, ifit is achievable it will be very useful for companies. Investors and the public will appreciate.

> Yes, if it works out an auditing model it will be a useful contribution in the area of environmental management for packaging business.

> Yes, is what multi-national companies should work out.

> Yes, auditing considerations could offershort and long terms improvements for companies and products.

> Possible, ifthe audit is not very expensive to run.

8) Do you believe that UK packaging companies incorporate an environmental audit programme review?

Item 8. - Frequency of similar words/phrases

Strongly believe *Always*	24
Tend to believe *Most of the time. Often.*	17
Tend to disbelieve. *Not very often/ Hardly ever*	46
Disbelieve strongly *Never*	32
No preference - *Not sure./ Do not know.*	12

8a) ***If the answer is positive*** **- Could you please give information about what the audit might involves?**

B2. Auditing the life-cycle stages of packaging. Packaging is a comparatively simple item made of few materials.

B8. Considerations about what primary material should be used and, the amount of energy required by the

system.
B17. Investigate the use of raw material; the energy used and the emission to air and water from the industrial process.
B19. Compliance with environmental legislation and standards.
B24. Considering what primary material should be used, the amount of energy required by the system. Also, the output of this process that gives emissions to air and water as well as pre-consumer waste which can be used again by the paper mill - and returned to the system.
B28. Audit to investigate compliance with legislation the use of raw material; the energy used and the emission to air and water from the industrial process.
B32. The inputs in this system are energy and materials and the outputs give again emissions and waste.
B34. Compliance with existing legislation, control the environmental impact from the industrial activities and ensure that management aspect related with corporate policy are met.
B35. The best option for a more efficient operation is resource management involve reduction in the use of raw materials in the production manufacturing stage - minimising the energy requirements and raw materials used up in the distribution, product use and disposal - leaving less packaging waste to deal with.
B36. Audit as a part of the organisation committed to improve its environmental performance. Used to ensures internal conformity to company policies and external level compliance with environmental regulations and standards. Conducting the audit also highlights the use of raw material, energy and waste generated from the company operations. In the long term the audit has financial implications, for example cost saving by the use of recycling materials, or alternative methods in production and operation.
B37. The audit could work to increase savings for the company in the future as it can estimate present costs regarding environmental pollution and consequent liabilities and suggest ways in conforming with legislation for example or waste savings during the manufacture process.
B43. Auditing the efficient operation of the client system, the use of legislation and the organisation commitment to improve its environmental performance.
B45. The audit examines options about recycling, reuse, refill and ways to control the environmental impact related with energy consumed for the collection of the containers and recycling infrastructure facility plus emissions to water e.g. de-inking.
B47. Audits carried out to safeguard compliance with legislation, to improve energy and the use of resources and, waste management audits for reduction or efficiency operation of the recycling process.
B50. Suppliers audits.
B52. Audited used for quality control and suppliers environmental performance.
B56. Compliance with legislation and standards, quality control and certification by BS7750.
B58. Audits contacted to measure suppliers environmental performance, safety audits and compliance with environmental legislation and standards.
B60. Auditing the efficient use of resources and emission to air and water pollution. Also compliance with legislation and certified by BS 7750.
B61. BS 7750 verification.
B62. Quality control and safety audits. Waste management audits and compliance with legislation.
B63. Control the environmental impact in the use of raw material, energy used and the emission to air and water from the industrial process.
B66. The audit examines suppliers performance and BS 7750 certification.
B67. Auditing compliance with legislation and impact areas.
B76. Quality and performance measurements.
B84. Examine compliance with legislation and corporate performance.
B92. The process deals with controlling the impact areas of our production - investigate the use of raw materials, energy and the emission to air and water on the industrial site.
B93. Examining suppliers environmental performance to meet our requirements and confront with legislation and policy targets.
B95. Auditing the manufacturing process and emissions to water. Waste management audits for reduction on the amount of waste produced, compliance audits with environmental legislation and, check management aspects related with corporate policy and targets.
B100. Compliance legislation audits. Audits to check the environmental policy is properly implemented and controlled, BS 7750 certification.
B102. Responsible to control the impact areas of our production and compliance with the existing legislation.
B108. The audit examines and controls the environmental impact areas, management practices and legislation compliance.
B109. Waste management and legislation compliance audits.
B111. Liabilities of present legislation, auditing environmental impact areas corporate policy targets.
C1. The scope of a recent audit involved re-designing primary and secondary packaging to fit as exactly as possible into transport containers' In this way there is a reduction in quantities of packaging materials needed, there is also a reduction in the transportation vehicles and in extension in the number of transportations - that have a significant environmental advance in energy saving and pollution from the vehicles.
C2. The audit examines the environmental impact of company's operation in different stages and evaluates the best environmental option according to existing legislation and company's policy.
C3. The eco-audit confirms that the corporation complies with existing environmental legislation.

C4. Auditing activities verify that the examined site conform with existing legislation and, explore options for future investments and profit for the company.
C5. Environmental audits include audits which carried out to verify whether the company it is complying with existing environmental legislation and environmental performance standards.
C8. Compliance with environmental legislation and check adaptability with management aspect related with corporate policy, BS 7750.
C12. Auditing should examine the different types of paper based packaging for example regarding its weight - as a result of market research and suppliers audits. Environmental auditing can give considerations about the construction of the packaging, such attention should be in three areas: the product to use the minimum space that satisfy product protection and safety criteria; eliminate cut - unused paper and, during distribution - in relation to transport of bulk quantities.

Item 8a. - Frequency of similar words/phrases

Compliance with legislation	24
Control Environmental Impact	15
Specific management aspect related with corporate policy *e.g. BS 7750*	14
Particular area of the organisation operation *e.g. energy and resources conservation*	6
Waste management audits	6
Suppliers audit	5
Quality control audits	5
Verifying operation systems	2
Cost saving audits	3

9) If you feel that you want to make any suggestion or offer any comment in relation to the current state of environmental auditing and LCA with regards to paper packaging products, please do so?

B2. The benefits of LCA and auditing methodologies is that is assist benchmark in the current levels of environmental performance and support companies in complying with current environmental legislation and standards.
B7. The eco auditing offers real benefits to the organisation committed to improve its environmental performance, because it ensures internal conformity to company policies and external level compliance with environmental regulations and standards.
B8. LCA and eco-auditing support business to identify their strengths and weakness in the operation and control system - and indicates areas where there are opportunities for improvements.
B17. Auditing needs to work on improvements in the efficiency of handling and distribution system.
B18 For companys' in the 1990s a major challenge is to re-examine products portfolios by developing LCA methodologies integrated into the wider environmental objectives and management systems of the company.
B32. Auditing methodologies and LCAs should be used in improvements in the use of materials.
B33. Conducting the audit should highlights the use of raw material, energy and waste generated from the company operations. In the long term the audit has financial implications, for example cost saving by the use of recycling materials, or alternative methods in production and operation.
B34. There are a lot of parametres to be considered in developing proper LCA methodologies, including the location of the company with regards to the reusability of the product, or the establishment of recycling facilities, or the cost to obtain recycled fibres, like post-consumer waste;

B35. LCA and auditing studies recommended to evaluate the cost of sourcing the raw material, the potential reduction in the use of material during the manufacture process, the potentials of designing for reuse the product or part of it.
B37. Assessment methodologies provide evaluation of the production/ use/ disposal and should be reported in a format that evaluate the whole process and closely monitors possible future improvements.
B40. The auditing process should formulated as a long term investment in raising the need for developing sustainable standards.
B43. Feasibility studies that address a pragmatic approach to the comparison of environmental investment and cost benefit analysis.
B45. Environmental design audits should provide comparisons and recommendations about the best environmental friendly option in the use of material and construction of the packaging.

B47. LCAs in the use of materials are urgently required.
B49. The development of LCA methodologies for packaging can make environmental claim more meaningful.
B53. Publicised comparative studies with products in the same product category will reveal potential areas of improvement.
B55. LCAs address the environmental impact of the product in all life-cycle stages
B59. Implementation of LCA methodologies for the design and production of a particular product related with company's environmental policy has potentials in the developing area of strategic environmental management.
B63. LCA and eco-auditing methodology supply guidance for business in selecting environmentally preferred materials and manufacturing process - assist business in specifying requirements to their suppliers.
B69. The conducting of LCAs and auditing give potential for improvements on the environmental performance of packaging but, better guidelines in conducting auditing required.
B71. LCA and auditing might offer long terms benefits on the organisation commitment to improve its environmental performance but tend to be expensive and time consuming to run.
B84. Such methodologies could provide for business a way to back up marketing environmental claims by present the scientific results of such techniques.
B91. Environmental auditing methodologies could help companies financially in long terms as many investors are demanding better environmental accounting.
B93. At present there is a growing body of environmental standards being developed almost exclusively by the global business community. In Europe companies have adopted eco-auditing methodology to identify areas where they can become environmentally sound and also reduce waste and increase productivity.
B94. LCA and auditing increase market share for businesses by enable them to demonstrate a proactive approach towards the environment.
B95. There is an emerging need for organisation's to take into consideration the impact of their business activities on society and earth resources and make an effort to assess and reduce such impact. LCA and auditing are tools on hand for such purposes.
B96. Industrial ecology and total quality management are mostly used for the greening of todays' business auditing methodologies should be developed in the same level.
B102. Probably auditing the industrial process is a useful indicator for packaging business but, auditing activities tend to be expensive to run.
B117. The global marketplace is demanding a new vision of management and product development. Ironically, there are more laws regulating environmental compliance across the world - than there are standards to understand the elusive concepts of sustainability and Total Quality Environmental Management (TQEM).
C1. It would be desirable the results of LCA methodologies or other feasibility studies for paper packaging products must be evaluated with regards to the system that the whole company operates. .
C2. LCA process should formulated as a long term investment in raising the need for developing sustainable standards and indicators about the design of products and methodology to increase accuracy and control in the provision of environmental information and claims.
C3. The development of LCA and auditing for packaging could assist the development of an international eco-labelling system commonly accepted and recognised.
C4. Environmental policies and programs as the most important non-financial information investors need when they examine the corporate profile of a company. Eco-auditing assist in the efficient operation of policy.
C8. The auditing results should address the environmental impact of the product in all stages from extract of raw material/ production/ use/ disposal and should be reported for external evaluation.
C10. Investing in LCA research and development for future product innovation.
C11. Auditing methodology should monitor in continuously improvements especially for products where technology changes rapidly e.g. packaging material; biodegradability.
C12. The use of LCA and auditing for packaging lead in creating innovative, environmental benign products. Such products' may appear to carry exceptional or additional environmental benefits, outside the scope of ecolabelling.

Model Prototyping Interviews Checklist

At ***Investigation Stage*** **Phase A.** each format of the *model* was evaluated during interview sessions. Based on the five different formats of the *models* development the interviews that took place grouped in five different stages apply for each model evaluation. The number of interviews are as follow:

1) *Evaluation of first format of the model.* Conducted to be interviewed 25 companies/organisations. - Interviewed 9.

2) *Evaluation of second format of the model.* Conducted to be interviewed 20 companies/organisations. - Interviewed 14.

3) *Evaluation of third format of the model.* Conducted to be interviewed 40 companies/organisations. - Interviewed 12.

4) *Evaluation of fourth format of the model.* Conducted to be interviewed 40 companies/organisations. - Interviewed 17.

5) *Evaluation of fifth format of the model.* Conducted to be interviewed 35 companies/organisations. - Interviewed 12.

Total Interviews *Investigation Stage Phase A.: Model Prototyping* = 64

The following section presents the materials and the interview checklist applying for each *model* stage.

SECTION 1. **Introduction** The aims of the Ph.D. research and the scope of the interview explained to the potential respondent. Prior to the interview copies of the *model(s)* and the evaluation questionnaire sent by post or by fax to the potential respondent. The materials were accompanied with a covering letter that summarised the aims of the project and the interview. It also, acknowledged the participants willingness to co-operate with the research, promised them that confidentiality will kept at any time and that the information provided will be used for academic purposes. In addition, to motivate the interviewers to participate it promised to let them know about the research outcomes if it was of their interest.

SECTION 2. **Personal Details - *Confidential***

Name: Occupation:
Address:
Tel.: Fax.: E-mail:

Business activity: ❑ Design Consultancy Packaging ❑ Environmental Consultancy Packaging
❑ Paper & board supplier ❑ Paper & packing manufacturer ❑ Packaging Retailer

For statistical purpose could you please let me know some information about your company.

Number of employees ❑ 1-49 ❑ 50-99 ❑ 100-249 ❑ 250-499 ❑ 500-1000 ❑ 1000+

Turnover ❑ Under £1 million ❑ £1-£5 million ❑ £6-£10 million
❑ £11-£25 million ❑ £26-£50 million ❑ £51-£100 million ❑ Over £100 million

SECTION 3. **Model Prototyping - *Evaluation Questionnaire***

The *model* I have sent you aims to be used by paper and packaging companies on the way to address and evaluate their environmental activities and performance. At present, the *model* is in a development stage and any recommendations for improvements will considered extremely valuable. The *evaluation questionnaire* I am sending you prior to the interview consists of nine items, provided below. Please feel free to make any additional comments and indicate any disagreement or misunderstanding in the format of the model.

1) Do you find the model to be effective in use by packaging constructor companies and paper manufacturers?
❑ Very effective (Go to 2.) ❑ Rather effective (Go to 1a.) ❑ Not very effective (Go to 1a.)
❑ Not at all effective (Go to 1a.) ❑ No preference

1a) If you have any reason to disapprove the effectiveness of the model, please feel free to state such reasons:.....

2) Do you understand the directions and the links indicated by arrows from one stage to another?

❑ Always (Go to 3.) ❑ Most of the time (Go to 2a.) ❑ Hardly ever (Go to 2a.) ❑ Never (Go to 2a.) ❑ No preference

2a) Please state if something is missing or not described adequately. .....

3) Are you familiar with the terminology used? ❑ Always ❑ Most of the time ❑ Hardly ever ❑ Never ❑ No preference

4) Does the terminology describe adequately well the stages indicated? ❑ Always (Go to 5.) ❑ Most of the time (Go to 4a.) ❑ Hardly ever (Go to 4a.) ❑ Never (Go to 4a.) ❑ No preference

4a) *If you feel that the terminology is not appropriate.* - Please feel free to make any suggestions.
.....

5) Is the model self explanatory from one stage to another?

❑ Always (Go to 6.) ❑ Most of the time (Go to 5a.) ❑ Hardly ever (Go to 5a.) ❑ Never (Go to 5a.) ❑ No preference (Go to 6.)

5a) Do you feel that more instruction is needed? .....

6) Do you think there is enough information and direction provided?

❑ Strongly agree (Go to 7.) ❑ Tend to agree (Go to 6a.) ❑ Tend to disagree (Go to 6a.) ❑ Disagree strongly (Go to 6a.) ❑ No preference (Go to 7.)

6a) Do you think that there is not enough of information/direction included? Please feel free to make any recommendations .....

7) Do you find the model to have a practical application for packaging businesses?

❑ Always (Go to 8.) ❑ Most of the time (Go to 8.) ❑ Hardly ever (Go to 7a.) ❑ Never (Go to 7a.) ❑ No preference (Go to 8.)

5a) Provided that the answer is negative or uncertain - Could you please state the reasons in support of the statement that the model has not a practical application for packaging businesses;
.....

8) Who do you believe could use the model?
a) Environmental manager *within the company*
❑ Always ❑ Most of the time ❑ Hardly ever ❑ Never

b) Environmental Consultancy *external* ❑ Always ❑ Most of the time ❑ Hardly ever ❑ Never

c) Environmental auditor (internal or external)
❑ Always ❑ Most of the time ❑ Hardly ever ❑ Never

d) Head of Design/ Design Manager
❑ Always ❑ Most of the time ❑ Hardly ever ❑ Never

e) Design Consultancy ❑ Always ❑ Most of the time ❑ Hardly ever ❑ Never

f) Other. (Please specify) .....
❑ Always ❑ Most of the time ❑ Hardly ever ❑ Never

9) Do you have to add any comments in relation to the model(s) and the research project.

Additional Comments .....

.....

.....

Thank you for your valuable help and co-operation.

Table III.1.: Content analysis of data collected from one-to-one evaluation
Model prototyping - First format

COMMUNICATION - USER UNDERSTANDING

+	The relationship of producer, purchaser and verifier is very transparent. The directions for the producer are precise. All the requirements of the consumer/purchaser included. The impact of environmental issues described adequately well.
-	Unfamiliar terminology e.g. ethical investment initiatives, ethical control system etc. that required additional thinking to understood.

PERFORMANCE - EFFECTIVENESS IN USE/ PRACTICALITY

+	Good hierarchy of producer activities. Appropriate use of the links from one stage to another.
-	More information required about eco-design characteristics and requirements. More explanation and directions about the legislative requirements and how to conduct an environmental impact assessment.

OTHER LACKING DETAILS

More specific directions should provided for the producer for example, how the environmental activities should established and how the environmental impact assessment and cost benefit analysis should be conducted.

SUMMARY OF SUGGESTIONS FOR IMPROVEMENTS

An explanatory document for the producer activities should accompanied the model.

Q1. ***Do you find the model to be effective in use by packaging constructor companies and paper manufacturers?*** **Q1a.** ***If you have any reason to disapprove the effectiveness of the model, please feel free to state such reasons.***

A1. The concept is rather effective, but more explanations required.
A2. Rather effective, the producer activities are prioritise relatively well.
A3. Not very effective too much information are included.
A4. I feel that it is over complicated.
A5. Rather effective, it is a good attempt in addressing the relationship of the environmental effects with the producer, verifier and purchaser. All the requirements of the purchaser/ consumer are included but for a practical application more information for the producer required.
A6. I do not think that is effective to used as it is but on the other hand as identify reasonable well basic relationships it has potentials for improvements.
A7. Rather effective but obviously more thinking required about how the model will operate in practice. An accompanied explanatory document about the use of the model might be useful material to be provided.
A8. Not very effective more explanation about design activities should be provided.
A9. I think it is too complicated, with so many considerations in small prints.

Q2. ***Do you understand the directions and the links indicated by arrows from one stage to another?***
Q2a. ***Please state if something is missing or not described adequately.***

A1. Yes, easy to follow.
A2. The diagramme illustrates clearly the relations from one stage to another.
A3. I do not think there is any problem to follow the links.
A4. Yes, the link are clear even if the diagramme is overload with information.
A5. I do not see any problem with the links, the diagramme flows nicely from one stage to another.
A6. Yes, very easily.
A7. The directions illustrate well enough the relations. What it makes it complicate is the use of too much information.
A8. The links are probably ok, what is required is reducing the amount of data or probably simplify the

design by emphasising the most important activities.
A9. The links are clear, think about reducing the information.

Q3. ***Are you familiar with the terminology used?***
Q4. ***Does the terminology describe adequately well the stages indicated?***
Q4a. ***If you feel that the terminology is not appropriate. - Please feel free to make any suggestions.***

A1. I found the terminology a little be complicated because I need to think for some time to understand what exactly the model tries to say.
A2. I believe most of the wordings are self explanatory but I have to say I have never come across with such terminology.
A3. I think that the terminology is not very clear. Even if I found the model as a good concept with lots of potentials I feel that the terminology should be more direct, simple and communicative.
A4. Not very clear. I have to admit that the interpretation of the model is good but the use of some wordings like ethical investment initiatives, ethical control system need more explanation.
A5. Basically it is ok but more considerations required.
A6. Most of terms are ok but some are extremely complicated and need more thinking or more information to be provided or even to be re-phrased for example ethical control system- what does it include - could instead be production control on ethical and environmental considerations or just controlling;
A7. I feel that the terminology used is a bit exaggerated instead it should follow rules of simplicity and be more communicative.
A8. I believe that the use of the terminology required more attention.
A9. I can understand most of it, some wordings are a bit complicated e.g. ethical control system needs more explanations.

Q5. ***Is the model self explanatory from one stage to another?***
Q5a. Do you feel that more instruction is needed?
Q6. ***Do you think there is enough information and direction provided?***
Q6a. ***Do you think that there is not enough of information/direction included? Please feel free to make any recommendations.***

A1. I feel that the stages are relatively well presented but more directions for the producer is required.
A2. I believe that more instructions required but without making the model more complicated than already is.
A3. The basic principles of the model is easy to be understood, the producer activities are in a good priority form, I feel that more information are required about how to proceed probably is a good idea the use of an accompanied document so the model is not over complicated.
A4. I do not think that the model is very easy to follow more instruction needed for the producer in order to use the model.
A5. I feel that it is relatively self explanatory but it has definitely potentials for improvements.
A6. Relatively easy to follow the basic concept, but more information required for the producer and the legal bindings of his actions.
A7. The model is easy to follow from one stage to another. More information are required about legislative requirements and about how to proceed in conducting an environmental impact assessment.
A8. Basically is easy to follow the main points but more information are required for the producer about how to proceed in achieving the desirable results.
A9. I believe that the model is relatively self explanatory from one stage to another. More information required about eco-design requirements and characteristics.

Q7. ***Do you find the model to have a practical application for packaging businesses?***
Q7a. ***Provided that the answer is negative or uncertain - Could you please state the reasons in support of the statement that the model has not a practical application for packaging businesses;***

A1. Not sure, more specific directions required.
A2. Probably if it provides more directions for the producer.
A3. The idea of modelling environmental activities in this form is interesting but I feel that it requires more work in order to have a practical application.
A4. If the model is more simplified and more direct it could work on a practical application.
A5. More information about suppliers audit considerations in establishing environmental activities and about conducted an environmental impact assessment should be provided.
A6. It is a good graphical interpretation but for a practical application more considerations required.
A7. It has potentials to have a practical application if it provides more clear and precise specifications for

the producer.
A8. Not sure. I feel that might need more improvements.
A9. It is an interesting interpretation of the relation between purchaser, producer and verifier but it remains complicated in the other parts and needs more directions about how to proceed.

Q8. ***Who do you believe could use the model?***

A1. Environmental manager
A2. Environmental auditor
A3. Environmental manager
A4. Environmental Consultancy(external)
A5. Environmental auditor
A6. Environmental Consultancy(external)
A7. Environmental manager
A8. Do not know.
A9. Probably by a governmental body*/Verifier.*

Q9. ***Additional Comments***
A1. I found interesting the table that shows the relationship between environmental labelling and investment in 'ethical' image. I believe that developing products which qualify for the Ecolabel or carry an environmental award will be further demonstration of commitment to environmental improvement
A5. I found useful the representation between environmental labelling and investment in 'ethical' image. It describes and categorise well the variation of businesses environmental performance.
A6. I think that the table represents the relationship between environmental labelling and investment in 'ethical' image, is a good indication of how many products with various environmental performance can still claim environmental credentials.
A7. The table represents the relationship between environmental labelling and investment in 'ethical' image, demonstrate a way of thinking about how to differentiate products environmental performance. It will be helpful if it could have more information to assess and evaluate environmental products characteristics.

FIRST Format of the model Interviews analysis - Demographics of the Subjects

Candidate	Occupation	Geographical area	Business activity	Number of employees	Turnover
A1.	Head of Production	Leeds	Packaging Constructor	250-499	£26-£50 million
A2.	Managing Director	Northampton	Packaging Constructor	250-499	Do not know
A3.	Packaging Controller	Middlesex	Packaging Manufacturer	250-499	£26-£50 million
A4	Specifier	East Midlands	Paper & board Suppliers	250-499	£51-£100 million
A5.	Mill Manager	Leicester	Paper & board Suppliers	250-499	£51-£100 million
A6.	Environm.Advisor	Nottingham	Environmental Consultancy	1-49	£1-£5 million
A7.	Manager	London	Environmental Consultancy	50-99	£26-£50 million
A8.	Head of Design	London	Design Consultancy	50-99	£6-£10 million
A9.	Chief Designer	London	Design Consultancy	1-49	£26-£50 million

Occupation	Geographical area	Business activity	Number of employees	Turnover
Head of Production/ Manager = 3 **Packaging Controller/ Specifier = 2** **Packaging Design = 2** **Environmental Advisor = 2**	UK based companies	**Packaging Constructor /Manufacturer = 3** **Paper & board Suppliers = 2** **Environm. Consultancy = 2** **Design Consultancy = 2**	1-49 = 2 50-99 = 2 250-499 = 5	£1-£5 million = 1 £6-£10 million = 1 £26-£50 million = 4 £51-£100 million=2 Do not know = 1

Table III.2.: Content analysis of data collected from one-to-one evaluation
Model prototyping - Second format

COMMUNICATION - USER UNDERSTANDING

+	Easy to understand the main points. Easy to understand the basic relations from one stage to another. Easy to understand the terminology.
-	Complicated directions/ links about how to achieve the main points. Very descriptive make it overcomplicated.

PERFORMANCE - EFFECTIVENESS IN USE/ PRACTICALITY

+	Interesting concept. Good realistic network of requirements for quality of life with quality of management
-	Too many information included. Not very direct the format from one stage to another. More precise directions about how to proceed appear to be necessary.

OTHER LACKING DETAILS

-	Complicated links and directions. Difficult to follow the sub-sections from one stage to another.

SUMMARY OF SUGGESTIONS FOR IMPROVEMENTS

More information about how to proceed in adopting environmental standards and performance requirements should be included.
It should re-formatted to be more direct and more easy to follow - by simplifying the links.
The minimum amount of information should be kept.
More considerations about the use of the terminology required.
Considerations should be directed in re-constructed the model without using arrows. *And, the option to replace the arrows with directions in rows step by step to follow have to be examined.*

Q1. ***Do you find the model to be effective in use by packaging constructor companies and paper manufacturers?*** **Q1a.** ***If you have any reason to disapprove the effectiveness of the model, please feel free to state such reasons.***

A1. I feel that the model have potentials to be used by packaging business it is a good concept but needs more work to be more effective and direct model.
A2. I believe that it is a realistic model as it includes current considerations for eco-design. It offers a good interpretation of the areas of concern but needs more improvements to be made in order to be a working model.
A3. It is a good prototype to start with, considering in simplifying it in order to work in practice.
A4. I feel that it is an instruction model that anticipates current difficulties facing packaging companies in creating an eco-design brief. It provokes the need for standardised system in place which should give directions about how to proceed but I am afraid the model itself it is over complicated to give clear directions and have a practical application.
A5. I have to appreciate that the model includes a good number of considerations for eco-design but it is a bit complicated to used in practice.
A6. I feel that the model should include more considerations in the use of materials but without being more complicated than it is.
A7. The basic concept is interesting but when I am coming in the details about how to do things I found it complicated.
A8. It is an interesting concept but I feel that it is not a working prototype.
A9. The basic message is clear the information about how to proceed are very complicated.
A10. The model is capable to be adopted but needs more simplification on the stages to be followed.
A11. I believe that the model touch upon so many areas of concern for environmental orientated packaging but needs more directions about how to proceed.
A12. Interesting interpretation of the relation of the design with the quality of life and quality of management - probably ISO 9000, what is not spell very well is how to move from theory in practice.
A13. How can one define sustainability there are so many considerations to be included, I feel an effort ought to be made to keep the minimum requirements of sustainable development and build on that for future improvements.
A14. I feel that the model made an interesting approach for ecological design. It provokes the need for a standardised design progress.

Q2. ***Do you understand the directions and the links indicated by arrows from one stage to another?*** **Q2a.** ***Please state if something is missing or not described adequately.***

A1. The basic steps from environmental issues to sustainable development spell out clearly the intermediate steps are complicated.

A2. I found myself overwhelmed with so many directions.
A3. I feel that is disturbing the use of so many links and arrows.
A4. Think about reducing the directions to the minimum.
A5. The directions and links appear to be a little be confusing.
A6. Too much material to anticipate.
A7. I believe that you have a good basic concept but the format of the directions make it complicated.
A8. Think about replacing the arrows with directions in rows step by step to follow.
A9. Include the minimum required information that can be self explanatory to follow.
A10. Even if I found useful the material included in the model the way that the links works with so many arrows and directions end to be confusing.
A11. It has so many directions and links that it makes it difficult to come across the message even if the considerations are in the right track.
A12. Too much information and sub-sections about how to proceed keep the basics.
A13. The directions are a bit to complicated.
A14. I feel that you have to simplify the links.

Q3. ***Are you familiar with the terminology used?***
Q4. ***Does the terminology describe adequately well the stages indicated?***
Q4a. ***If you feel that the terminology is not appropriate. - Please feel free to make any suggestions.***

A1. Considering to use the minimum amount of terminology.
A2. The terminology is a bit repetitive.
A3. More clarification required in some points.
A4. The basic concept it come across but when you are coming in details about how to achieve things the terminology does not help a great deal.
A5. I can understand easily the terminology. Think more carefully of the use of more precise definitions for example 'targeting' say what it involves.
A6. The terminology generally speaking is acceptable but I found it a bit repetitive and the directions complicated.
A7. The use of the terminology is ok. Give more explanations in some points for example pragmatic situation say what is about probably use complimentary information to make more clear the point.
A8. I feel that sustainability is not defined well in general and, I appreciate your attempt to make sustainable options more measurable considering simplicity and keep the minimum directions required.
A9. I found the use of the terminology well defined.
A10. The terminology is generally ok. Eco-assessment needs more explanations about what it might involves.
A11. Yes, I can understand the terminology. The use of terminology should give more indications about the stages that it describes for example give more explanations about what review activities deal with in the production stage.
A12. I appreciate that it does not exist design terminology for environmental orientated design but I still feel it is a little bit over descriptive the way that the terminology used in the model.
A13. It is a good effort to describe design considerations but it might required further work.
A14. More specifications required and, more simplified terminology should be used.

Q5. ***Is the model self explanatory from one stage to another?***
Q5a. ***Do you feel that more instruction is needed?***
Q6. ***Do you think there is enough information and direction provided?***
Q6a. ***Do you think that there is not enough of information/direction included? Please feel free to make any recommendations.***

A1. I believe that more clear instructions is what it needed.
A2. The basic intentions of the model come out quite clear the stages to follow appear to be complicated.
A3. I feel that the model has a logical base but the amount of the information include are a lot.
A4. The fundamentals intentions of the model are clear but there are too many information and complicated directions to follow.
A5. Explicitly in the use of information should apply better in the formulation of the model.
A6. More clear instructions required with less information presented.
A7. It appears that there is a good concept but more thinking is essential in presenting the instructions more clear and direct.
A8. I found myself distracting with so much directions to follow.
A9. It is a good effort in addressing so many issues try to keep the minimum information that are essential for the whole process.

A10. The model provides a good ground for developing standards for eco-design products but more clear specifications required.
A11. Think about reducing the amount of information presented.
A12. It address so many thinks that it makes it difficult to follow.
A13. I definitely believe that you need more clear instructions - too much information.
A14. I anticipate that there are so many considerations for ecological optimisation of products and packaging that it appears to be complicated to instruct them in one model, try to simplify it.

Q7. ***Do you find the model to have a practical application for packaging businesses?***

Q7a. ***Provided that the answer is negative or uncertain - Could you please state the reasons in support of the statement that the model has not a practical application for packaging businesses;***

A1. I feel that the model has potentials for practical application if modifications are going to be made in the use of terminology and the stages to follow are described in more simplicity format.
A2. I can not really say because I have never come across with something like this.
A3. More improvements required to be a working model.
A4. If the directions appeared more clear then it can be used in practice.
A5. I think it is an interesting concept but there is clearly space for improvements.
A6. I feel impress of the idea of modelling the activities to be followed for eco-optimised design requirements, but a revised version of the model required to succeed in this approach.
A7. The model needs to present more measurable requirements if it is going to work in practice.
A8. Think about giving more clear direction for the producer for a practical application of the model.
A9. I found it a good concept with interesting graphical represented relations but improvements should be made to be more practical approachable.
A10. There potentials for practical application if it use a more direct format.
A11. I found the model to be a good instruction model but for a working model more considerations required including the use of the terminology and the directions from one stage to another.
A12. I think that it is an interesting concept that needs to be explored further.
A13. I think that it is a useful model in support of environmental improvements and specifications for packaging but alterations required in the use of directions from one stage to another so it will allow a practical use.
A14. I think it is useful design model but needs more improvements in the part of the directions provided.

Q8. ***Who do you believe could use the model?***

A1. Environmental auditor
A2. Environmental Consultancy
A3. Environmental auditor
A4. Environmental auditor
A5. Environmental auditor
A6. Environmental auditor
A7. Governmental standardisation body
A8. Environmental auditor
A9. Environmental Consultancy
A10. Environmental Consultancy
A11. Governmental standardisation body
A12. Environmental auditor
A13. Independent design advisor *e.g. from a design society*
A14. Environmental auditor

Q9. ***Additional Comments***

A2. I found the Eco-Rating scale a good concept to addresses the environmental impact of the product in all stages of the products life-cycle. But I think is complicated all the information on the boxes and can not be read clearly.
A3. I think the Eco-S is a good graphical representation of the different levels of environmental concern and environmental performance it can well apply in a rating system.
A2. I think that the eco-s has potentials for evaluation of the environmental performance of the final product and packaging.
A6. I think the Eco-S is a good graphical representation of the different levels of environmental concern and environmental performance it can well apply in a rating system.
A8. I like the modelling of environmental performance on different levels of concern.
A9. I found the Eco scale a good material to assess the different level of environmental performance.

SECOND Format of the model Interviews analysis - Demographics of the Subjects

Candidate	Occupation	Geographical area	Business activity	Number of employees	Turnover
A1.	Managing Director	Lancashire	Packaging Constructor	250-499	£26-£50 million
A2.	Packaging Specifier	Beds	Packaging Constructor	250-499	£51-£100 million
A3.	Packag. Technologist	Manchester	Packaging Manufacturer	250-499	£26-£50 million
A4	Chief Designer	Cheshire	Packaging Manufacturer	250-499	£26-£50 million
A5.	Mill Manager	Manchester	Packaging Manufacturer	250-499	£26-£50 million
A6.	Production Manager	Nottingham	Paper & board Suppliers	250-499	£51-£100 million
A7.	Production Specialist	London	Paper & board Suppliers	250-499	£51-£100 million
A8.	Material Technologist	London	Paper & board Suppliers	250-499	Do not know
A9.	Environm.Advisor	Surrey	Environmental Consultancy	50-99	£26-£50 million
A10.	Environm.Advisor	Middlesex	Environmental Consultancy	1-49	£1-£5 million
A11.	Managing Director	Manchester	Environmental Consultancy	50-99	Do not know
A12.	Head of Design	East Midlands	Design Consultancy	250-499	£26-£50 million
A13.	Senior Designer	S Humberside	Design Consultancy	50-99	Do not know
A14.	Manager	London	Design Consultancy	1-49	£26-£50 million

	Occupation	**Geographical area**	**Business activity**	**Number of employees**	**Turnover**
	Managing Director/ Production Manager = 5 **Packaging Specifier/ Technologist = 4** **Designer = 3** **Environm.Advisor = 2**	UK based companies	**Packaging Constructor /Manufacturer = 5** **Paper & board Suppliers = 3** **Environm. Consultancy = 3** **Design Consultancy = 3**	1-49 = 2 50-99 = 3 250-499 = 9	£1-£5 million = 1 £26-£50 million = 7 £51-£100 million= 3 Do not know = 3

Table III.3: Content analysis of data collected from one-to-one evaluation
Model prototyping - Third format

COMMUNICATION - USER UNDERSTANDING

+	Reliable plan of activities.
-	Overload with information. Unknown terminology (indicated by four subjects)

PERFORMANCE - EFFECTIVENESS IN USE/ PRACTICALITY

+	It includes appropriate environmental management principles. Efficient priority of activities. Satisfactory quality of information.
-	Too many stages to follow. - *Make it probably difficult to have a practical application.*

OTHER LACKING DETAILS

-	Complex thinking process. Difficult to memorise and recall the stages to be followed when is required.

SUMMARY OF SUGGESTIONS FOR IMPROVEMENTS

Simplify the structure. Reduce the stages to be followed. - *Make it more communicative and easy to follow.* Reduce the amount of information -*simplicity.*

Q1. ***Do you find the model to be effective in use by packaging constructor companies and paper manufacturers?*** **Q1a.** If you have any reason to disapprove the effectiveness of the model, please feel free to state such reasons.
A1. I feel that the model has far too much information on display.
A2. I think you have to reduce the amount of information to the minimum required to bring the message

across.
A3. I think alterations required to make the model appear to be more direct and communicative.
A4. I think that the model should be simplified.
A5. I found difficult to memorise and recall the stages to be followed when required.
A6. I rather prefer the use of existing terminology and simplified the link.
A7. I think that the model follows a complex thinking process.
A8. I feel that the model present lots of information.
A9. I think that the model presents appropriate environmental management principles.
A10. I found satisfactory quality of information
A11. I think that the model prioritise efficient the activities to be followed but, I believe that the presented information should be reduced.
A12. I think that the plan of activities is well established but the amount of information makes it a bit confusing.

Q2. ***Do you understand the directions and the links indicated by arrows from one stage to another?***
Q2a. ***Please state if something is missing or not described adequately.***

A1. I found the links clear enough.
A2. I do not have any problems with the directions and links about how to proceed.
A3. I believe that the links are fine.
A4. I can easily understand the links from one stage to another.
A5. I think the links use a very simplify format.
A6. I prefer more simplified links and directions.
A7. I think that the directions are planed very well.
A8. I do not have any problem with the links.
A9. I think the planning of the model and the directions are ok.
A10. I found directions easy to understand.
A11. I think the layout of the model is clear.
A12. I do not have any problem to follow the links.

Q3. ***Are you familiar with the terminology used?***
Q4. ***Does the terminology describe adequately well the stages indicated?***
Q4a. ***If you feel that the terminology is not appropriate. - Please feel free to make any suggestions.***

A1. I feel that the terminology used is ok.
A2. I think the terminology used needs revision.
A3. I believe that the terminology used describes well the stages to be follow but, where existing terminology describes the same stages the one that it used should be replaced.
A4. I feel that the terminology is ok.
A5. I do not see any problem with the use of terms.
A6. I rather prefer the use of existing terminology and simplified the link.
A7. I am not very familiar with the use of that terminology.
A8. I feel that the use of terminology requires additional considerations.
A9. I think that the terms used describe the stages to be follow precisely but more thinking required to replace some terms with existing ones. I feel that you invent your own terms and even if they are right to describe what it meant to - that makes the model complicated.
A10. I found the use of terms interesting.
A11. I feel that the terms describe adequately well the stages to be followed but the model is overloaded with information and that it makes it complicate.
A12. I found the use of terminology difficult to understand.

Q5. ***Is the model self explanatory from one stage to another?***
Q5a. ***Do you feel that more instruction is needed?***
Q6. ***Do you think there is enough information and direction provided?***
Q6a. ***Do you think that there is not enough of information/direction included? Please feel free to make any recommendations.***

A1. I feel that the model is easy to understand.
A2. I think that the model is self explanatory and direction provided are clear the big number of stages to be followed makes it complicated.
A3. I think that the model requires less material on display and instruction about how to proceed can be supplied in an accompanied document.
A4. I feel that the instructions are clear but on the other hand very descriptive.

A5. I found difficult to remember the stages to be followed and I think this is a problem of planning the format of the model.
A6. I think that the model is self explanatory in some degree but it has far too much information to understand.
A7. I think that the model requires to minimise the amount of presented information.
A8. I feel that the model is a good approach in dealing with environmental management and strategic planning but I would prefer it more direct so it can be easy to understand from people that are not working in the area of environmental management and consultancy.
A9. I like the format of the model and I can say that it is a good concept. I also feel that needs to use less information to make the point.
A10. I found satisfactory the use of information and the level of understanding is good.
A11. I can understand the thinking behind the model but I need some time to think about planning the activities indicated.
A12. I think that it requires less information on display.

Q7. ***Do you find the model to have a practical application for packaging businesses?***
Q7a. ***Provided that the answer is negative or uncertain - Could you please state the reasons in support of the statement that the model has not a practical application for packaging businesses;***

A1. I feel that the model has potentials for practical use but needs some modifications to be made in relation to the amount of information required to be direct and more effective.
A2. I think that the model as it is, is complicated for a practical application reducing the amount of information and improve the use of terminology will make much more applicable.
A3. I think alterations required for a practical application I found complicated at present the amount of information and the stages to be followed.
A4. I think that the model use efficient priority of activities but is complex for a practical application.
A5. I think is difficult to have a practical application in this format improvements need to be made in order to simplify the stages to be followed.
A6. I recommend the use of terms need alterations for a practical use of the model.
A7. I believe that the model underpins a good thinking in a complex form.
A8. I feel that the model has too many information on display for a practical application.
A9. I think that the model touch upon appropriate areas of environmental management system and I have to say I have never see something similar from BS or ISO in this format. But, I am afraid such environmental management model should use more simply structure.
A10. I feel that the model has potentials for a practical application.
A11. I think that the quality of presented information is of high standards. I believe that it is a good theoretical model with potentials for use.
A12. I think considerations should be directed in minimising the amount of data for a practical application.

Q8. ***Who do you believe could use the model?***

A1. Environmental auditor	**A2.** Environmental manager	**A3.** Governmental Body
A4. Environmental auditor	**A5.** Environmental Consultancy	**A6.** Governmental Body
A7. Environmental auditor	**A8.** Design Consultancy	**A9.** Environmental manager
A10. Governmental Body	**A11.** Environmental auditor	**A12.** Design Consultancy

Q9. ***Additional Comments***
A1. I like the concept of the model and the auditing activities provided in the figure *(Organisational Plan for Audit consideration)* accompanied - that touch upon the basic frame of auditing procedures and I feel that it is in a more simplified format than the main model.
A9. I think that the model touch upon appropriate area on environmental management system and I have to say I have never see something similar from BS or ISO in this format. But, I am afraid such environmental management model should use more simplify structure.
A10. I feel that the model has potentials for a practical application and the auditing considerations accompanied the model are in a good structure.
A11. I think that the quality of presented information are of high standards. I believe that it is a good theoretical model with potentials for use.
A12. I think considerations should be directed in minimising the amount of data for a practical application of the model. I found the auditing considerations to be very applicable.

THIRD Format of the model Interviews analysis - Demographics of the Subjects

Candidate	Occupation	Geographical area	Business activity	Number of employees	Turnover
A1.	Packag. Controller	Middlesex	Packaging Constructor	250-499	£26-£50 million
A2.	Studio Manager	Leeds	Packaging Constructor	500- 1000	Over £100 mil.
A3.	Project Leader	Berkshire	Packaging Manufacturer	500- 1000	£51- £100 million
A4	Production Director	Hants	Packaging Manufacturer	250-499	£51- £100 million
A5.	Systems Engineer	Bristol	Paper & board Suppliers	500- 1000	Over £100 mil.
A6.	Packaging Specialist	Cambs.	Paper & board Suppliers	500- 1000	Do not know
A7.	Advisor	Oxford	Environmental Consultancy	1-49	£26-£50 million
A8.	Environm. Officer	London	Environmental Consultancy	250-499	£1-£5 million
A9.	Advisor Manager	Cambs.	Environmental Consultancy	250-499	Do not know
A10.	Pack. Consultancy	Derbyshire	Design Consultancy	50-99	£1-£5 million
A11.	Chief Designer	Cambs.	Design Consultancy	50-99	£51- £100 million
A12.	Technical Advisor	Nottingham	Design Consultancy	50-99	£26 - £50 million

Occupation	Geographical area	Business activity	Number of employees	Turnover
Manager/Production Director = 3	UK based companies	**Packaging Constructor**	1-49 = 1	£1-£5 million = 2
Packaging Controller/		**/Manufacture = 4**	50-99 = 3	£26-£50 million = 3
Specialist/Engineer = 6		**Paper & board Suppliers = 3**	250-499 = 4	£51- £100 million=3
Environm. Advisor = 2		**Environm. Consultancy = 4**	500-1000 =4	Over £100 mill. = 2
Designer/ Project Leader = 3		**Design Consultancy = 3**		Do not know = 2

Table III.4: Content analysis of data collected from one-to-one evaluation
Model prototyping - Fourth format

COMMUNICATION - USER UNDERSTANDING

+	Clear directions provided. Good interpretation of the links between the presented data. Useful information material.
-	Too much information included. (indicated by six subjects) Not easy to memorised and recalled the presented information and the stages to be followed when is required. (indicated by three subjects)

PERFORMANCE - EFFECTIVENESS IN USE/ PRACTICALITY

+	Clear format of the presented information. Easy to follow from one stage to another. It has a lot of potential for practical application. Interesting concept with aspects close to the ISO standards on environmental management systems but, formatted very differently.
-	Takes time to understand the process and anticipate every single aspect of the model. Not enough explanation about the impact of the use of strategic control to the environmental policy.

OTHER LACKING DETAILS

-	Rather descriptive - makes it less communicative.

SUMMARY OF SUGGESTIONS FOR IMPROVEMENTS

Reduce the amount of information to the minimum required to explain the point.
Explain better the auditing procedures.
Use a different template for auditing activities.
Use existing terminology where available, recommended terminology for use is from the ISO 14001.
Simplify links make it more easy to follow

Investigation Stage: Phase A. Model prototyping Interviews checklist and Content analysis

SPECIAL CONSIDERATIONS

Redesign the model keeping the minimum amount of information required.
Examine the option of using sub-models that illustrate additional speculations of parts in conducting environmental activities.

Q1. ***Do you find the model to be effective in use by packaging constructor companies and paper manufacturers?*** **Q1a.** ***If you have any reason to disapprove the effectiveness of the model, please feel free to state such reasons.***

A1. I feel that the model has potentials for use by packaging companies.
A2. I like the concept but I feel the less material that includes the better.
A3. I feel that it is a good conceptual model.
A4. I believe that it is very interesting and closely related with the ISO and BS on environmental management systems.
A5. I like the idea that the model try to bring across.
A6. I think it has potentials to be effective if the terms are understood better.
A7. I feel that it is a bit complicated to be very effective.
A8. I think it is a good instruction model.
A9. I found the model to have potentials but more work probably required to make it more communicative and direct.
A10. I like the idea of this model but I am not sure how effective it can be. I feel that if it gives more specifications for the producer it will be more effective.
A11. I think that the model is effective in some degree think about minus alterations in the use of information and the terminology.
A12. I found the model to describe well the auditing process but I feel it is another level of activities that should be presented separately.
A13. I like the idea of this model, I like how it called what it is a little bit confusing is the terminology used that I have not come across before.
A14. I am pleased with this model. I think it is a good prototype to be explored more.
A15. I feel it is relatively effective more planning required in the use of the data in order to subtract the most important.
A16. I think it is ok but, you need to spend some time to understand the whole process.
A17. I think it is a good prototype but needs more work to be more effective.

Q2. ***Do you understand the directions and the links indicated by arrows from one stage to another?***
Q2a. ***Please state if something is missing or not described adequately.***

A1. I feel that the directions are clear enough.
A2. I feel that the indications are clear.
A3. I do not have any problem with the directions.
A4. I feel that the directions are ok.
A5. I feel that the format of the direction is clear.
A6. I feel that the directions stated very obviously.
A7. I do not see any problem with the directions.
A8. I think the links stated sufficient clear.
A9. I believe that the directions and the links are clear - especially in the auditing cycle.
A10. I feel the directions on the model are clear and easy to understand.
A11. I feel the stages and directions are very transparent.
A12. The links are not complicated.
A13. I feel that the links are working.
A14. The indications from the arrows are easy to followed.
A15. I think that the directions are easy to follow.
A16. I can easily understand the directions.
A17. I feel that the directions are bring the relation from one stage to another quite well.

Q3. ***Are you familiar with the terminology used?***
Q4. ***Does the terminology describe adequately well the stages indicated?***
Q4a. ***If you feel that the terminology is not appropriate. - Please feel free to make any suggestions.***

A1. I feel that the terminology requires additional thinking.
A2. I feel that the use of terminology should be improved, probably is better to replaced with existing terminology where applicable.
A3. I am not very familiar with the terminology and as a result I need more time to understand the process.
A4. I feel that the terminology needs more thinking.
A5. I believe that the terminology could improved.
A6. I feel that the terminology is something that needs to be considered for further improvements.
A7. I am able to understand the terminology.
A8. I think some terms need more explanations for example 'revise effects', is better to be as precise as possible.
A9. I do not have any particular problem to understand the terms but I feel that need more considerations.
A10. I think that is an interesting terminology but I feel that because is invented by the research makes it difficult to communicate effectively.
A11. I feel that the terminology should be borrowed from the ISO 14001 on environmental management systems.
A12. I like how the model called but I do not have any problem to understand the terminology.
A13. I feel there is some space for improvements in the use of terms - be more precise.
A14. I think that the terminology is ok.
A15. I think that the terms need additional explanations.
A16. I feel that the terminology is relatively ok - I found very appeal to me.
A17. I think that the terminology is overal ok, but I feel that need some more explanations in some terms e.g. 'revise effects'.

Q5. ***Is the model self explanatory from one stage to another?***
Q5a. ***Do you feel that more instruction is needed?***
Q6. ***Do you think there is enough information and direction provided?***
Q6a. ***Do you think that there is not enough of information/direction included? Please feel free to make any recommendations.***

A1. I feel that the model is relatively self explanatory.
A2. I feel that the indications are clear but the amount of information can be reduced.
A3. I feel there are quite a lot of information.
A4. I think that the information are ok.
A5. If the information can reduced the model will be more communicative and easy to understood.
A6. I think there are good relations indicated but if the information reduced to the minimum the model will be more effective. Think about the use of a complimentary document that provides details information about how to proceed.
A7. I believe that the information are a lot I do not feel really confused with it but I do not know how essentials are all the information provided.
A8. I think the relations from one stage to another will be more clear and direct if less material will included.
A9. I think that the auditing cycle could stand alone in separate model as a part of the main model EMCS.
A10. I feel that the presented information are ok.
A11. I think that the lesser information used the better.
A12. I found myself a bit confused with so many material included even if the directions/connections from one stage to another is clear and precise.
A13. I feel that the amount of information included in the model requires more considerations in the sense of simplified their wordings and minimise their use.
A14. In some respect I found the model too cluttered with data.
A15. I think that needs more planning in the use of information
A16. I think that the use of data is relatively ok.
A17. I think the basic thinking of the model is good. Probably the use of more precise directions it will improve the quality of the model.

Q7. ***Do you find the model to have a practical application for packaging businesses?***
Q7a. ***Provided that the answer is negative or uncertain - Could you please state the reasons in support of the statement that the model has not a practical application for packaging businesses;***

A1. I think that it is a good concept with lots of potential for practical application.
A2. I think that it is a good theoretical model in managing ecological notions.

A3. I think that the whole process need to be more transparent - some more clear information might included but without making it overwhelming with data.
A4. I think it probably have a practical application. I found it easy to follow from one stage to another.
A5. I feel that the model has lots of potentials for practical application.
A6. I think that the model has a good format that if it clarified more in terms of the terminology used, it will make it more easy to used.
A7. I think if the model modified to be more close to the requirements and specifications of ISO 14000 - it will be more easy to adopted in practice.
A8. Interesting concept with aspects close to the ISO standards on environmental management systems but, formatted very differently.
A9. I think it is a good model with potentials to be explored more its use.
A10. It is a good basic concept close to the ISO standards on environmental management system but with another format.
A11. I am not sure about the practical application of the model in this form I think more improvements in the use of terminology need to be made. Think about dividing the model in smaller units attached to a basic - main model- that it will be less descriptive model than it is now.
A12. I am not sure if the model has a practical application.
A13. I think the model has potentials to indicate directions for companies.
A14. I think the auditing part of the model has more practical application.
A15. I feel that the model needs to be more simplified to work in practice - most of the practical models already in existence based onto rules of direct format and simplicity.
A16. I think that it has potentials to work - the design process should be indicated.
A17. I believe is a good concept but needs more thinking for practicalities of its use, more directions might required.

Q8. ***Who do you believe could use the model?***

A1. Environmental auditor	**A2.** Environmental manager	**A3.** Environmental auditor
A4. Environmental Consultancy	**A5.** Environmental auditor	**A6.** Environmental manager
A7. Environmental auditor	**A8.** Environmental auditor	**A9.** Environmental Consultancy
A10. Environmental Consultancy	**A11.** Environmental auditor	**A12.** Environmental manager
A13. Environmental auditor	**A14.** Environmental auditor	**A15.** Environmental manager
A16. Environmental manager	**A17.** Environmental Consultancy and design consultancy.	

Q9. ***Additional Comments***
A1. I found the EMCS to be a positive response for business environmental commitments. We are having BS7750 and ISO 9000 certification.
A2. By introducing management systems in our operation like EMAS it helps control current and future environmental liabilities and complying with environmental legislation and standards which is a part of our policy.
A3. Energy efficiency and waste minimisation are two areas in which we achieved cost regular savings.
A5. We are considering to have good environmental records because they provide good reputation for the company to attract investors and secure insurance costs. In addition to that I believe that environmentally responsible corporate image - well managed environmental activities appeal positively to shareholders, employees, pressure groups and media.
A6. We examined options for cost savings in the use of energy and waste minimisation. We also considered profiling a good environmental performance of our business and we use BS5750 certification.
A7. We improve our environmental performance so it can acceptable in the market. We also finance environmental groups initiatives. We adopt EU environmental requirements and certified by BS7750 and BS5750 - we look also certification from ISO 9000.
A8. It is very common for large companies to force their suppliers or contractors to have environmental specification and environmental management system in place also, to be accredited by BS7750, ISO 14000 BS5750 and ISO 9000. I think the model support companies to formulated requirements for certification on environmental management systems.
A9. I believe that by examining environmental performance initiatives and market competitive can give marketing opportunities arising from the 'green' consumers preferences also form stakeholders and investors. The development of environmental management systems for todays' packaging companies is essential requirement in the market.
A10. I believe that the reasons for companies introducing environmental management systems include cost savings on the efficiency use of energy and resources.
A12. There are increases in taxes on energy, transport and waste disposal. Companies that are undertaken action to reduce energy, resources and waste production are going to be better positioned.

A14. I believe that by examining environmental performance initiatives like EMAS, ISO 14000, BS5750 and market competitive can give marketing opportunities arising from buyers preferences also form stakeholders and investors.
A15. I like the format of the model because it provides considerations similarly with BS7750 and ISO 14000 on environmental management systems. Also, from my experience I believe that companies should take special environmental considerations into account when they market overseas and there are different environmental legislation applied on products requirements- if they do not their exports will facing problems.

FOURTH Format of the model Interviews analysis - Demographics of the Subjects

Candidate	Occupation	Geographical area	Business activity	Number of employees	Turnover
A1.	Pack. Consultant	Lincs.	Packaging Constructor	100 - 249	£26-£50 million
A2.	Packaging Specialist	Leeds	Packaging Constructor	500 - 1000	Do not know
A3.	Pack. Co-ordinatror	Newcastle	Packaging Manufacturer	250-499	Do not know
A4	Packaging Designer	Bristol	Packaging Manufacturer	100 - 249	Do not know
A5.	Quality Manager	Gloucestershire	Paper & board Suppliers	500 - 1000	£51-£100 million
A6.	Developm. Manager	Hertfordshire	Paper & board Suppliers	250-499	£51-£100 million
A7.	Design Manager	Nottingham	Paper & board Suppliers	100 - 249	£26-£50 million
A8.	Commercial Manager	East Midlands	Paper & board Suppliers	250-499	£51-£100 million
A9.	Environ.Researcher	London	Environmental Consultancy	50-99	Do not know
A10.	Environm. Advisor	Bristol	Environmental Consultancy	1-49	£1-£5 million
A11.	Environ. Consultancy	Nottingham	Environmental Consultancy	50-99	£6-£10 million
A12.	Materials Specifier	Derby	Environmental Consultancy	1-49	£1-£5 million
A13.	Environm. Advisor	Manchester	Environmental Consultancy	50-99	Do not know
A14.	Head Packag.Design	Kent	Design Consultancy	1-49	£6-£10 million
A15.	Chief Designer	London	Design Consultancy	50-99	£51-£100 million
A16.	Head of Production	London	Design Consultancy	50-99	£26-£50 million
A17.	Packag. Designer	Oxfordshire	Design Consultancy	1-49	£6-£10 million

	Occupation	**Geographical area**	**Business activity**	**Number of employees**	**Turnover**
	Head of Production/ Manager= 4	UK based companies	**Packaging Constructor /Manufacturer = 4**	1-49 = 4	£1-£5 million = 2
	Packaging Specifier/Specialist = 2			50-99 = 5	£6-£10 million = 3
	Packaging Design = 7		**Paper & board Suppliers = 4**	100 -249 = 3	£26-£50 million = 2
	Environmental Advisor/Researcher = 4		**Environm. Consultancy = 5**	250-499 = 3	£51-£100 million =4
			Design Consultancy = 4	500-1000 =2	Do not know = 5

Table III.5: Content analysis of data collected from one-to-one evaluation
Model prototyping - Fifth format

COMMUNICATION - USER UNDERSTANDING

+	Good design considerations. - *Easy to understand.* Interesting conceptual modelling of eco-design characteristics. Good quality of information. Terminology easy to understand and precise.
-	More details explanations about how to proceed in achieving measurable results is missing out. The relation of the company with the product is not very direct.

PERFORMANCE - EFFECTIVENESS IN USE/ PRACTICALITY

+	Tactful comparison of eco-design with traditional design and the effects for product design and packaging are addressed. The basic concept of the model come out clearly. The directions and links are transparent.

-	The directions need additional explanations about how to proceed. It does not come easily across the practical application of the model.

OTHER LACKING DETAILS

-	The model lacking in providing specific guidelines for the producer.

SUMMARY OF SUGGESTIONS FOR IMPROVEMENTS

The role of EMAS and environmental management systems need more emphasis and more explanations for a more realistic approach in improving quantifiable results.

SPECIAL CONSIDERATION

More considerations and indications should apply in the relation of the company with the product.
More explanations required for the company how to achieve performance standards.

Q1. ***Do you find the model to be effective in use by packaging constructor companies and paper manufacturers?*** **Q1a.** ***If you have any reason to disapprove the effectiveness of the model, please feel free to state such reasons.***

A1. I think that more information required about how to proceed in creating eco-design products and packaging.
A2. I believe that provides a good quality of information but needs more explanation about how to achieve measurable results.
A3. I think that is a good concept that requires to be explored more in relation to manufacturing process.
A4. I found the model interesting in providing a framework for eco-design.
A5. I feel that the model should provide more specific directions about how to proceed in achieving sustainable targets.
A6. I think it is a good concept but more emphasis required in the organisational plan that enables companies to achieve ecological production.
A7. I think that the model has potentials to be effective as it provides a good basic design thinking.
A8. I found that the model indicates clearly areas of environmental concern but it required additional information on how to achieve measurable improvements.
A9. I think that it should be spelled better the relation of the product with the company and the requirements of a design brief.
A10. I believe that it is an interesting interpretation that bridge ideas of traditional design with eco-design but to be effective needs to provide more information for the producer on how to achieve eco-production.
A11. I think that the model indicates clearly the relation of traditional design with eco-design.
A12. I believe that the model presents good considerations for eco-design products.

Q2. ***Do you understand the directions and the links indicated by arrows from one stage to another?***
Q2a. ***Please state if something is missing or not described adequately.***

A1. I think that the direction are clear.
A2. I believe that there are lots of directions.
A3. I think that the direction are clearly assembled.
A4. I believe that the links indicated well enough.
A5. I think that there lots of directions and that makes the model confusing.
A6. I can understand the directions.
A7. I think that the directions planned clearly.
A8. I found the links from one stage to another are clear and direct.
A9. I think that the directions described adequately well.
A10. I found the instructions and links very transparent.
A11. I do not see any problem with the directions.
A12. I believed that the directions can be simplified by reducing the amount of text accompanied the directions.

Q3. ***Are you familiar with the terminology used?***
Q4. ***Does the terminology describe adequately well the stages indicated?***
Q4a. ***If you feel that the terminology is not appropriate. - Please feel free to make any suggestions.***

Investigation Stage: Phase A. Model prototyping Interviews checklist and Content analysis

A1. I found the terms easy to understand.
A2. I do not see any problem with the terminology.
A3. I think that the terms are very clear and precise.
A4. I believe that the terminology is appropriate.
A5. I believe that the terms defined well.
A6. I can understand the terms.
A7. I think that the terminology is ok.
A8. I think the terminology used is very clear.
A9. I think the terminology is clear and direct.
A10. I found the terminology easy to understand.
A11. I do not see any problem with the terms.
A12. I believe that the terms are ok, but try to avoid to use abbreviation like LCA or EMAS.

Q5. ***Is the model self explanatory from one stage to another?***
Q5a. ***Do you feel that more instruction is needed?***
Q6. ***Do you think there is enough information and direction provided?***
Q6a. ***Do you think that there is not enough of information/direction included? Please feel free to make any recommendations.***

A1. I think that the direction are clear.
A2. I believe that there are lots of directions.
A3. I think that the direction are clearly assembled.
A4. I believe that the links indicated well enough.
A5. I think that there lots of directions and that makes the model confusing.
A6. I can understand the directions.
A7. I think that the directions planned clearly.
A8. I found the links from one stage to another are clear and direct.
A9. I think that the directions described adequately well.
A10. I found the instructions and links very transparent.
A11. I do not see any problem with the directions.
A12. I believed that the directions can be simplified by reducing the amount of text accompanied the directions.

Q7. ***Do you find the model to have a practical application for packaging businesses?***
Q7a. ***Provided that the answer is negative or uncertain - Could you please state the reasons in support of the statement that the model has not a practical application for packaging businesses;***

A1. I believed that the model includes practical aspects of design considerations but required more indication about how companies can proceed in achieving measurable results.
A2. I believe that the model provides clear practical eco-design considerations.
A3. I think that the model has potentials for practical application.
A4. I believe that more explanation required on the operation and requirements of environmental management systems.
A5. I think it probably has.
A6. I feel that the model has potentials for practical application but need more specification about how to proceed.
A7. I am not very sure about the practical application of the model. I believe that it needs to follow more simple structure.
A8. I think it might has if it provides more explanation about environmental performance standards.
A9. I think that needs to improve the structure by presenting less data to have a practical application.
A10. I found the model to be of interest and it might has a practical application if it provides more clear directions for the producer.
A11. I am not sure.
A12. I believe environmental performance standards and how these affect eco design should be explained in more details.

Q8. ***Who do you believe could use the model?***

A1. Head of Design/ Design Manager
A2. Environmental Consultancy
A3. Environmental Consultancy
A4. Design Consultancy
A5. Environmental Consultancy
A6. Environmental Consultancy
A7. Environmental auditor
A8. Environmental auditor
A9. Environmental Consultancy
A10. Environmental auditor
A11. Environmental Consultancy
A12. Design Consultancy

Q9. ***Additional Comments***
A1. I think that sustainable options for packaging should considered reducing production cost and using resources and energy more efficiently.
A2. We examine potentials to improve or replace our machinery in order to reducing running cost.

A3. Our production lines considered managing waste and recycling also reducing disposal cost as our obligations for the 'end-of-life' products.
A4. We try to minimise the amount of waste we produced.
A5. We support the use of reclaimed and renewable resources instead of finite ones.
A7. I think that the model indicates a way to improve products' environment qualities.
A9. I am supportive of the idea of better business management and loss control throughout the product life cycle
A10. I believe that the use of environmental reporting and the appropriate use of clear product labelling increasing customer confidence and loyalty for the company.
A12. I believe that it required to check your supplier environmental activities regarding the material handling and process

FIFTH Format of the model Interviews analysis - Demographics of the Subjects

Candidate	Occupation	Geographical area	Business activity	Number of employees	Turnover
A1.	Project Leader	Nottingham	Packaging Constructor	500-1000	£51-£100 million
A2.	Manager	Middlesex	Packaging Manufacturer	500-1000	£51-£100 million
A3.	Packing Manager	Bedford	Packaging Constructor	500-1000	Over £100 mill.
A4	Packaging Controller	East Surrey	Paper & board Suppliers	250-499	£51-£100 million
A5.	Materials Developm. Officer	South Yorkshire	Paper & board Suppliers	250-499	£26-£50 million
A6.	Environm. Advisor	Kent	Environmental Consultancy	1-49	£1-£5 million
A7.	Manager	London	Environmental Consultancy	50-99	£26-£50 million
A8.	Environmental Manager Associate	Hampshire	Environmental Consultancy	50-99	£1-£5 million
A9.	Packaging Designer	Birmingham	Design Consultancy	250-499	Over £100 mill.
A10.	Senior Graphic Controller	Bedford	Design Consultancy	250-499	£26-£50 million
A11.	Packaging Specialist	Swindon	Design Consultancy	250-499	£26-£50 million
A12.	Head of Design	London	Design Consultancy	50-99	£6-£10 million

Occupation	Geographical area	Business activity	Number of employees	Turnover
Manager/Head = 4	UK based companies	**Packaging Constructor**	1-49 = 1	£1-£5 million = 2
Packaging Specialist/		**/Manufacturer = 3**	50-99 = 3	£6-£10 million = 1
Controller = 3		**Paper & board Suppliers = 2**	250-499 = 5	£26-£50 million = 4
Environm. Advisor = 2		**Environm. Consultancy = 3**	500-1000 =3	£51-£100 million =3
Designer = 3		**Design Consultancy = 4**		Over £100 mill. = 2

1st *Page Survey.* html

Environ Info System

Environmental Effects on Business Management & Information System

Elli Sarri. Ph.D. Research Student.
De Montfort University. School of Design & Manufacture.
The Gateway. Leicester. LE1 9BH. UK

Introduction Project Survey

Thank you in advance for your help and co-operation!

2nd *Page Survey.* html

Introduction

[redacted]

At present I am conducting doctoral research for the Department of Design Management in the School of Design and Manufacture, De Montfort University, Leicester.

The project is in the area of environmental issues and business performance. It involves the creation of models for environmental analysis and ecological auditing towards standards for products and their packaging.

It would be valuable for my current research if you could spare some of your time not more than ten to fifteen minutes to respond to a short answer questionnaire.

If you are interested to know the results of the survey, please tick the box indicated by the end of the questionnaire, and I will be pleased to inform you about the results and the progress of the research.

If you would like your responses to be kept strictly confidential please indicate it in the box after your personal details.

Click here if you want to know about the research project Project

Click here if you want to go in the survey page Survey

Thank you in advance for your help and co-operation!

4th *Page Survey.* html

FIRST PAGE QUESTIONNAIRE

Environ Info System

Environmental Effects on Business Management & Information System

About the Survey

The reason for this survey is to gain business responses to environmental issues. In particular what environmental activities do companies carry out and how do they address their environmental achievements.

The survey is also aiming to identify areas of 'weakness' in particular where more environmental investment should be made; And, in the part of the organisational system on business corporate activities to identify problems which have environmental implications ir the operation and control system;

There are four sections in this questionnaire: (All short answers questions)

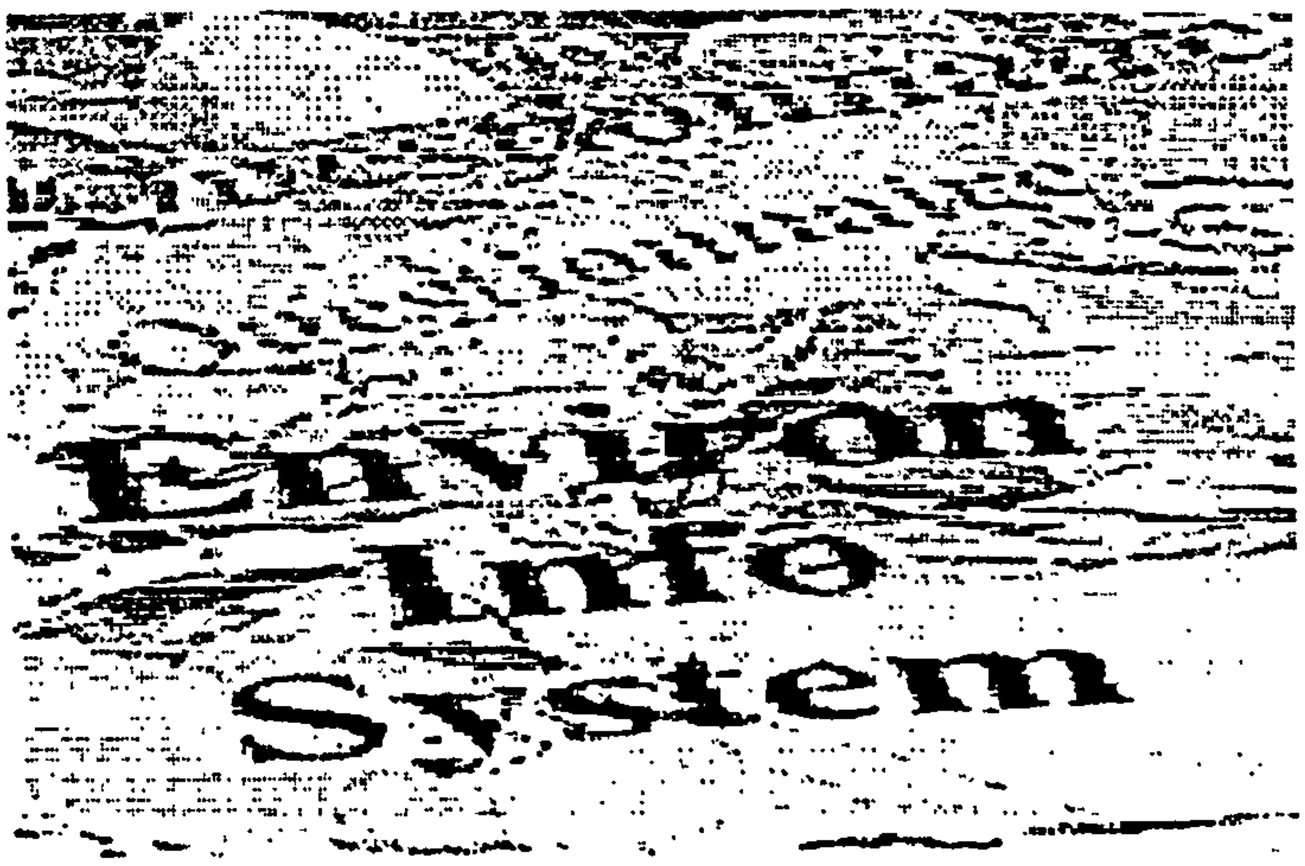
- **Section 1.** - Personal views on business environmental debate
- **Section 2.** - Corporate Environmental Profile
- **Section 3.** - Environmental Management approach
- **Section 4.** - File: Feedback sheet

The results of the survey will be considered as a part of the progress for the research project. The aim is to build models for realistic ecological audits to be adopted as part of normal business operations.

The analysis of your response will further contribute to exploring options and establishing standardisation procedures for products and their packaging.

Thank you in advance for your participation

Any suggestion and comment are particularly welcome!



DE MONTFORT
UNIVERSITY
LEICESTER

School of Design and
Manufacture

Dale JP
Design Manager,
RPC Group plc.
Broadfield House,
Grove Street., Raunds,
Northamptonshire,
NN9 6ED

Example of covering letter sent with questionnaires to companies

Dear Mr. Dale,

Ref.: Environmental Information Survey

I spoke today with you on the phone regarding the survey I am conducting as part of my PhD studies about environmental auditing and labelling for products and packaging.

I would like to thank you for agreeing to complete the enclosed questionnaire. I appreciate the pressures on your time but would appreciate it if you could spare 10 minutes completing the survey and send it back on the SAE provided.

If you would like to be informed about the results of the survey, please indicate it at the end of the questionnaire. I would be happy to send you the results report at the end of June '98. Confidentiality will be kept for all replies.

I would greatly appreciate your prompt reply
Thank you in anticipation.

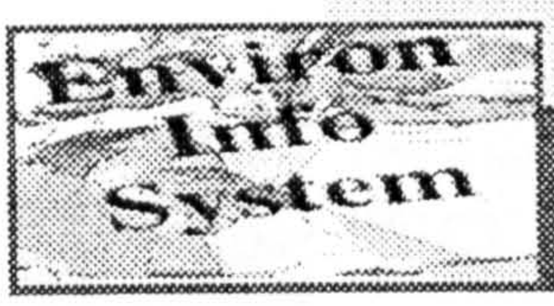
Kind Regards,

Elli Sarri, M.A., IoP
Ph.D Research Student, De Montfort University

Home address: Flat 5, 19 Tower Street, Leicester, LE1 6WU. E-mail.: esarri@dmu.ac.uk

SURVEY

Elli Sarri
Ph.D. Researcher Faculty of Art and Design
Graduate School of Design & Manufacture. De Montfort University. Leicester
The Gateway Leicester. LE1 9BH. UK



Environmental Effects on Business Management & Information System

At present I am passing a survey on the web site at the location: **<http://www.dmu.ac.uk/~esarri/Environ.html>**

The reason for this survey is to gain business responses to environmental issues.
In particular what environmental activities do companies carry out and how do they address their environmental achievements. The survey is also aiming to identify areas of 'weakness' in particular where more environmental investment should be made; And, in the part of the organisational system on business corporate activities within the design process, to identify problems which have environmental implications in the operation and control system;

The results of the survey will be considered as a part of the progress for the Ph.D. research project "Environmental auditing and labelling for products and packaging". The aim is to build models for realistic ecological audits to be adopted as part of normal business operations. The analysis of your response will further contribute to exploring options and establishing standardisation procedures for products and their packaging.

Thank you in advance for your help and co-operation.

If you would like to be informed about the results of the survey, please indicate it at the end of the questionnaire.

There are four sections in this questionnaire: [All short answers questions]

Section 1. - Personal views on business environmental debate
Section 2. - Corporate Environmental Profile
Section 3. - Environmental Management approach
Section 4. - File: Feedback sheet

Thank you in advance for your participation. Any suggestion and comment are particularly welcome!

Section 1.- Personal views on business environmental debate

1. Do you believe that environmental issues are highly important in business operations?

Very Important ☐ Rather Important ☐ Not very Important ☐ Not at all Important ☐

2. What do you believe are the main motivations for companies response in the environmental agenda?

Ethical investment / responsibilities.
Agree strongly ☐ Tend to agree ☐ Tend to disagree ☐ Disagree strongly ☐
Environmental Legislation / penalties.
Agree strongly ☐ Tend to agree ☐ Tend to disagree ☐ Disagree strongly ☐
Consumer Pressure - Green marketing.
Agree strongly ☐ Tend to agree ☐ Tend to disagree ☐ Disagree strongly ☐
Codes of Practice - EMAS/ BS 7750/ ISO 9000,14001.
Agree strongly ☐ Tend to agree ☐ Tend to disagree ☐ Disagree strongly ☐
Competitive position from other business environmental initiatives.
Agree strongly ☐ Tend to agree ☐ Tend to disagree ☐ Disagree strongly ☐
Environmental profit *(profit from investment in 'clean technology' or by putting in place a reusing system, recycling facilities or giving in the product extra price because of its 'environmental' characteristics etc.)*
Agree strongly ☐ Tend to agree ☐ Tend to disagree ☐ Disagree strongly ☐
Other ☐ Please state your opinion : _____
_____
_____

page 1

3. When did you first introduce environmental requirements on products and/ or services?

1975 or before ☐ 1976 to 1980 ☐ 1981 to 1984 ☐ 1985 to1987 ☐ 1988 to 1990 ☐ 1991 ☐
1992 ☐ 1993 ☐ 1994 ☐ 1995 ☐ 1996 ☐ Not yet ☐

4.What proportion of information about environmental implications for business activities did you learn from each of the following sources?

College, Studies
Always ☐ 75% of the time ☐ 50% of the time ☐ 25% of the time ☐ Hardly ever ☐ Never ☐
Conference
Always ☐ 75% of the time ☐ 50% of the time ☐ 25% of the time ☐ Hardly ever ☐ Never ☐
Exhibition
Always ☐ 75% of the time ☐ 50% of the time ☐ 25% of the time ☐ Hardly ever ☐ Never ☐
Journal/ Publications
Always ☐ 75% of the time ☐ 50% of the time ☐ 25% of the time ☐ Hardly ever ☐ Never ☐
Clients requirements
Always ☐ 75% of the time ☐ 50% of the time ☐ 25% of the time ☐ Hardly ever ☐ Never ☐
Other ☐ Please be more specific: _____

5. Could you please explain what environmental practice means to you?

Adopting environmental legislation and standards.
Agree strongly ☐ Tend to agree ☐ Tend to disagree ☐ Disagree strongly ☐
If so, which one is in place now, in your company? _____

Support community environmental relation programmes.
Agree strongly ☐ Tend to agree ☐ Tend to disagree ☐ Disagree strongly ☐
Encourage customers to consider in depth the environmental implication of your business activities.
Agree strongly ☐ Tend to agree ☐ Tend to disagree ☐ Disagree strongly ☐
Integrate environmental management in corporate level.
Agree strongly ☐ Tend to agree ☐ Tend to disagree ☐ Disagree strongly ☐
Recognise environmental risks as part of the normal checklist of risk assessment and management.
Agree strongly ☐ Tend to agree ☐ Tend to disagree ☐ Disagree strongly ☐
Checking your suppliers approach to environmental standards/ official certificate.
Agree strongly ☐ Tend to agree ☐ Tend to disagree ☐ Disagree strongly ☐
Giving environmental information to consumers in an ethical context.
Agree strongly ☐ Tend to agree ☐ Tend to disagree ☐ Disagree strongly ☐
Other ☐ Please state: _____

Section 2. - Corporate Environmental Profile

1. When did your organisation start its initiatives to be environmental responsible?

1975 or before ☐ 1976 to 1980 ☐ 1981 to 1984 ☐ 1985 to1987 ☐ 1988 to 1990 ☐ 1991 ☐
1992 ☐ 1993 ☐ 1994 ☐ 1995 ☐ 1996 ☐ Not yet ☐

2. Does your organisation have an environmental policy? ***(i.e. something in writing)***

Always ☐ Nearly Always ☐ Often ☐ Hardly ever ☐ Never ☐

page 2

2.a) When was the policy formally established?

More than four years ago ☐ Three years ago ☐ Two years ago ☐ Last year ☐ This year ☐

3. Could you please state what sort of environmental commitments the particular policy implies ? For example:

Compliance with Legislation;

Always ☐ 75% of the time ☐ 50% of the time ☐ 25% of the time ☐ Hardly ever ☐ Never ☐

Control Environmental Impact;

Always ☐ 75% of the time ☐ 50% of the time ☐ 25% of the time ☐ Hardly ever ☐ Never ☐

Specific management aspect related with corporate policy systems; e.g. BS 7750.

Always ☐ 75% of the time ☐ 50% of the time ☐ 25% of the time ☐ Hardly ever ☐ Never ☐

Particular area of organisation operation; e.g. energy and resource conservation.

Always ☐ 75% of the time ☐ 50% of the time ☐ 25% of the time ☐ Hardly ever ☐ Never ☐

Waste management audits;

Always ☐ 75% of the time ☐ 50% of the time ☐ 25% of the time ☐ Hardly ever ☐ Never ☐

Suppliers audits;

Always ☐ 75% of the time ☐ 50% of the time ☐ 25% of the time ☐ Hardly ever ☐ Never ☐

Quality control audits;

Always ☐ 75% of the time ☐ 50% of the time ☐ 25% of the time ☐ Hardly ever ☐ Never ☐

Verifying systems;

Always ☐ 75% of the time ☐ 50% of the time ☐ 25% of the time ☐ Hardly ever ☐ Never ☐

Cost saving audits;

Always ☐ 75% of the time ☐ 50% of the time ☐ 25% of the time ☐ Hardly ever ☐ Never ☐

Other ☐ Please specify: _____

_____

_____

_____

4. Has your organisation changed its environmental policy over the last decade?

Yes* ☐ No ☐ Not sure ☐

*If yes: **4 a) Can you recall when it was?** _____

_____

4 b) What was the principal catalyst for the change of policy? _____

_____

_____

_____

5. Which of the following describes best for you the term 'environmental audit'?

A management tool to control business environmental activities.

Agree strongly ☐ Tend to agree ☐ Tend to disagree ☐ Disagree strongly ☐

An environmental analysis process in corporate level.

Agree strongly ☐ Tend to agree ☐ Tend to disagree ☐ Disagree strongly ☐

A business commitment to safeguard compliance with environmental legislation & standards.

Agree strongly ☐ Tend to agree ☐ Tend to disagree ☐ Disagree strongly ☐

A way to talk and present companys' environmental performance.

Agree strongly ☐ Tend to agree ☐ Tend to disagree ☐ Disagree strongly ☐

A format to check business environmental impact.

Agree strongly ☐ Tend to agree ☐ Tend to disagree ☐ Disagree strongly ☐

Other ☐ Please state: _____

_____

_____

_____

page 3

6. Does your company hold environmental audits which address the impact of its whole operation?

Always ☐ Nearly Always 75% of the time ☐ 50%of the time ☐ 25% of the time ☐
Hardly ever ☐ Never ☐

6a) Could you please state how frequently your company has environmental audits?

One every year ☐ One every two years ☐ One every three years ☐
Other ☐ Please be more specific: _____

7. Does your company hold a particular audit for individual products or services?

Always ☐ Nearly Always ☐ 75% of the time ☐ 50%of the time ☐ 25% of the time ☐
Hardly ever ☐ Never ☐

7a)Could you please state how frequently does your company have environmental audits for products and/or services?

One every year ☐ One every two years ☐ One every three years ☐
Other ☐ Please be more specific: _____
* If the answer is positive, please give an example: _____

_____
_____
_____
_____

8. Which of the following difficulties do you most encounter when implementing an environmental audit review? For example:

Difficulties to collect appropriate data.
Always ☐ Nearly Always ☐ Often ☐ Hardly ever ☐ Never ☐

Difficulties to control the whole process.
Always ☐ Nearly Always ☐ Often ☐ Hardly ever ☐ Never ☐

Difficulties to find the appropriate staff.
Always ☐ Nearly Always ☐ Often ☐ Hardly ever ☐ Never ☐

Difficulties to cope with resources and cost involved.
Always ☐ Nearly Always ☐ Often ☐ Hardly ever ☐ Never ☐

Clear guidelines not available.
Always ☐ Nearly Always ☐ Often ☐ Hardly ever ☐ Never ☐

Other ☐ Please state: _____

_____
_____
_____
_____

Section 3. - Environmental Management approach

1. How does your company carry out its environmental activities?

We employ an external environmental consultant.
Very likely ☐ Likely ☐ Unlikely ☐ Very unlikely ☐

We have an environmental management team in place.
Very likely ☐ Likely ☐ Unlikely ☐ Very unlikely ☐

We collaborate with external environmental auditors.
Very likely ☐ Likely ☐ Unlikely ☐ Very unlikely ☐

We collaborate with independent governmental bodies/ verifiers.
Very likely ☐ Likely ☐ Unlikely ☐ Very unlikely ☐
Other ☐ Please state: _____

_____
_____

page 4

2. Does your company present its environmental activities/ performance?

Always ☐ Nearly Always ☐ Often ☐ Hardly ever ☐ Never ☐

2.a) If your company is presenting its environmental performance, could you please state to which of the following groups?

Stakeholders.

Always ☐ 75% of the time ☐ 50% of the time ☐ 25% of the time ☐ Hardly ever ☐ Never ☐

Board of the Directors.

Always ☐ 75% of the time ☐ 50% of the time ☐ 25% of the time ☐ Hardly ever ☐ Never ☐

Employees.

Always ☐ 75% of the time ☐ 50% of the time ☐ 25% of the time ☐ Hardly ever ☐ Never ☐

Governmental Bodies.

Always ☐ 75% of the time ☐ 50% of the time ☐ 25% of the time ☐ Hardly ever ☐ Never ☐

Interested parties.

Always ☐ 75% of the time ☐ 50% of the time ☐ 25% of the time ☐ Hardly ever ☐ Never ☐

General public.

Always ☐ 75% of the time ☐ 50% of the time ☐ 25% of the time ☐ Hardly ever ☐ Never ☐

Other ☐ Please be more specific: _____

_____

_____

_____

3. Does your company publish an environmental review statement?

Always ☐ Nearly Always ☐ Often ☐ Hardly ever ☐ Never ☐

4. What is the format of the presented information?

Environmental report,

Always ☐ Nearly Always ☐ Often ☐ Hardly ever ☐ Never ☐

Leaflet,

Always ☐ Nearly Always ☐ Often ☐ Hardly ever ☐ Never ☐

Fact sheet for individual products or particulars activities,

Always ☐ Nearly Always ☐ Often ☐ Hardly ever ☐ Never ☐

Other ☐ Please state: _____

5. How often you report environmental activities?

Sequence -e.g. Annual / Twice a year/ Monthly/ Weekly

_____

_____

_____

_____

Format - In what publication format?

_____

_____

_____

_____

6. Is it possible to send me ***[the address provided at the front page]*** **a copy of your environmental report or other environmental statements publications ;**

Yes ☐ No ☐

7. Your Own View: How can companies anticipate and plan for future trends on environmental product development?

_____

_____

_____

_____

_____

_____

_____

_____

_____

page 5

_____

_____

_____

_____

_____

For this last open question you can give your opinion or provide examples of best practice. Please feel free to make any recommendation.

Thanks again for your help and co-operation!

Any additional comments are particularly welcome.

Additional Comments: _____

_____

_____

_____

_____

_____

_____

_____

Please continue in a seperate sheet if necessary.

Section 4. - Feedback sheet - Personal Details

Title Mr. Mrs. Ms. Miss.Other:_____**Initial:** _____**Surname:**_____
Job Title : _____ **Company :**_____
_____**Business Activity :**_____
Number of Emloyees: 1-49 [ ] 50-99[ ] 100-249[ ] 250-499[ ] 500-1000[ ] 1000+[ ]
Turnover of Company: Under a million[ ] £1-£5 million [ ] £6-£10 million[ ] £11-£25 million[ ] £26- £50 million [ ] £51 - £100 million [ ] Over £100 million [ ]
Address: _____
Town:_____**Post Code:**_____
Tel:_____ **Fax:**_____ **E-mail:**_____

For statistical purpose, it would be appreciated if you complete the following:

Age Group: 29 or younger.☐ 30-36. ☐ 37-46. ☐ 47 or older ☐

Educational level: HNC/HND☐ First Degree ☐ Postgraduate Certificate/ Diploma ☐
Masters Degree ☐ Other ☐Please specify :_____

Professional experience - Position: Years:

_____ _____
_____ _____
_____ _____
_____ _____
_____ _____

1. Do you want to remain anonymous? Yes☐ No☐

2. Do you wish to be informed about the results of the survey? Yes☐ No☐

3. Are you willing to co-operate again during the process of the research? Yes☐ No☐

Thank you very much for sparing the time to help!

page 6

Table V.1. Observations from Survey Piloting

First Format of the *Questionnaire*

The first format of the survey questionnaire consisted from two section plus an introductory section that stated the reason for the survey and has space for the respondents to complete their personal details. The first section of the questionnaire had eight items.

The first item asking the respondent to state what environmental practice means for him, the second what is the main motivation for his business to be environmental responsible, the third how his company carry out its environmental activities, the fourth how it would be described the term environmental audit, the fifth if his company hold an environmental audit, the six if the audit address the impact of the whole company's operation, the seventh if the company hold an audit for individual products and services and finally what difficulties does the company have to cope with when it carries out an environmental audit review.

The second section consisted of seven items. The first asking from the respondent to state if his company presents its environmental activities to stakeholders, the second if his company presents its environmental activities to general public, the third if his company hold an environmental review statement, the fourth what is the format of the presented information, the fifth how often does the company report its environmental activities, the sixth if it was possible to send a copy of the environmental report or other environmental statements/publications, and finally space provided for additional comments.

LACKING DETAILS

Time to load the web page. Time required to think and complete the answer in detail.

SUMMARY OF SUGGESTIONS FOR IMPROVEMENTS

Where applicable provide a list of considerations or activities for the respondent to choose from. Some items of the questionnaire required more description. Personal details should be confidential to secure unbiased replies. The size of the respondents organisation should be specified.

Comments: Twenty people participated in the first piloting of the survey. The most important comments were the following.

▷ Section 1. Item 1. I believe that companies will claim that they comply with legislation. Provide a list of environmental compliance areas for the respondent to choose from for example checking your suppliers approach to environmental standards, recognise environmental risks as part of the normal checklist of risk assessment and management. (Researcher)

▷ Section 1. Item 2. Suggest create a hierarchy give 1 to higher and put down to maybe five reasons. (Environmental Auditor)

▷ Section 1. Item 2. You will need to be very tactful to get reliable answers here most companies may not wish to be quoted. (Packaging Consultancy)

▷ Section 1. Item 4. An hierarchy of activities may be best since participants may wish to include more than one category. (Environmental Researcher)

▷ Section 1. Item 8. I suggest to make your categories for subsequent analysis and leave open the item of what difficulties companies have in controlling the whole process when carry an environmental audit review. (Engineer)

▷ Section 2. Item 2. Surely it's the form of presentation which counts respondents on your questionnaire might say 'yes' if they simply put one sentence about their intentions on their products or publicity. (Head of Environmental Affairs)

▷ Section 2. Item 5. Try to give more specifications by asking who they report their environmental activities and for public may be weekly in leaflets and annually for shareholders. (Product Designer)

▷ Section 2. Additional Comments. Consider the time for loading the web page, it might be a reason for not getting replies. Check also possible willingness of the respondents to co-operate again. (Lecturer)

▷ Section 2. Additional Comments. I see from your email list that you have included a number of small companies and charities. I think you should ask people to specify the size of their firm (unless you are taking turnover etc. data from Companies House) otherwise you will miss a very important factor. My answers to the first part of the survey are a reflection of the very low regard to environmental issues that most firms give. If you excluded firms smaller than, say, 1000 employees or a turnover of £100 million, then your results would, I suspect, be very different. (Assistant Director, Environment Unit)

Second Format of the *Questionnaire*

The second format of the survey questionnaire presented on the following pages (p.58-62 in appendix IV). It should be noted however that the included questionnaire pages are the final ones. The second format that piloted through a web page design was very similar like the one included. The changes were as follows.

LACKING DETAILS

Revision of the specified options applied in some items. Efforts should be made to include all the existing considerations.

SUMMARY OF SUGGESTIONS FOR IMPROVEMENTS

Pre-recorded values to scaled items and, reconsidered the existing values to be more precise and descriptive. Think about correlation's between the items.

SUMMARY OF CONSIDERATIONS

Consider sending the survey by post as well by e-mail.

Comments: Eighteen people participated in the second piloting of the survey. The most important comments were the following.

▷ **SECTION 1. Item 2. Comments *Other*:** 'Implementation of codes of EMS is usually driven by end-users e.g. Sainsbury's demand ISO9000 from their suppliers some of whom are anticipating Sainsburys' by also implementing ISO140001. Most (I would argue all) companies that put in environmental reporting are doing so because it gives them a competitive edge, not for moral reasons. e.g.: BT, GKN, BAe et al.' Environment, Risk and Safety Executive, Engineering Council

▷ **SECTION 1. Item 2. Comments *Other*:** 'Companies need to put more resources and co-operate in some sort of take back system. Most current practice in most industries is outdated. If the patience and research is done, most will find very yielding opportunities if they are willing to take the chance at non conventional or new practices. There seems to be an insecure sentiment from industry. Companies are just trying to satisfy conservative shareholders not looking into long term progress. Once the opportunity is exhausted, they simple move their money. We really need help from governments unifying their positions on pollution, landfill etc. Once laws are in place whereby they are applied to products sold in particular markets, then all companies wishing to participate in that market simply must comply. By having non partisan industry 'watch dogs' in place with political and associative power (perhaps knowledge public opinion), multinationals might be more congenial towards sustaining their! markets for the benefit of all. Currently, the macro accounting of most companies, does not surpass the 5 year. plan. I see very little progress with this end in mind. According the United Nations Environmental Program, by the year 2050, there lies a 50% chance the world population will be 12 Billion. With this population looking to sustain the American way of life, we have a clear problem with resource consumption consequences (pollution, health, long-term effects etc.). When it is too late, it is too late.' Environmental Researcher

SECTION 1. Item 5. *Could you please explain what environmental practice means to you?*

▷ ***Adopting environmental legislations and standards*** 'For profit-making organisations compliance is the main driving force particularly now that the size of fines for non-compliance is so high. The best practice I have seen in Environmental Practice is the BT Environment Week and all the community programmes associated with it (in case you're wondering I don't work for BT, or have any other connection exempt as a consumer). In engineering (my sector) it is not usually a good idea to make the customers think too hard about the environment, unless in 'end-of-pipe' sectors. Environmental management is not management unless driven from the top it MUST be incorporated into the company plan, else it is worthless the backing of the board is essential so that they can effectively inform shareholders of the benefits of environmental management. Engineers (professional, registered engineers, that is) have to follow a code of professional practice on Risk Issues and another on Environmental Issues. If they are found not to have done so, they can be struck off the register. A part of EMS is to keep stakeholders informed of environmental policy and performance. This includes consumers as well as local community. "Environment, Risk and Safety Executive' *Engineering Council*

▷ ***Other***: 'Governments for take back legislation and zero packaging goal within the next couple of years is possible if enough people do something about it. Germany is a reasonable success at least as a start. We simply must start somewhere and work from there.' *Environmental Researcher*

▷ **SECTION 2. Item 3.** 'Corporate environmental policies are a waste of time' *Assistant Director, Institute of Economic Affairs*

▷ **SECTION 2. Item 3.** 'The organisation wrote and implemented a Code of Professional Practice on Environmental Issues in 1993 and followed this up with a set of Guidelines. These are applicable to all professional engineers registered in the UK. As they were created before the publication of EMAS/ISO14001 these standards were not taken into account, but provision is made for such systems. The Guidelines will be re-written in 1997/8 to cover all the above." *Environment, Risk and Safety Executive, Engineering Council - Piloted Survey*

▷ **SECTION 2. Item 4 a)** '1993' *Because of:* 'Demand from engineers who were working on Risk Analysis for more information about environmental risk and management.' Environment, Risk and Safety Executive, Engineering Council

SECTION 2. Item 5. Additional Comments: about *'a format to check business environmental impact'*

▷ 'Disagree strongly', 'an exercise in propaganda, obfuscation and evasion' *Assistant Director, Environment Unit, Institute of Economic Affairs*

▷ Agree strongly, 'A complete analysis of the environmental impact of all company consequences. i.e.: related to the products they sell.' *Environmental Researcher*

▷ **SECTION 2. Item 6. Other** 'Never EMAS does not yet cover office-only functions where the organisation is a tenant and has no control over its waste stream once created. A study into whether the organisation could apply EMS was carried out three years ago, before the standards were complete and it concluded that it was not appropriate at that time. With the re-write of the Guidelines, this position will be reviewed.' *Environment, Risk and Safety Executive, Engineering Council*

▷ **SECTION 2. Item 7. If the answer is positive, please give an example:** 'LCAs of packaging' *Head of Environmental Affairs*

▷ **SECTION 3. Item 1.** *Other* 'The organisation has close ties with two verifying companies (including Lloyd's Register) and has a very close working relationship with the Department of the Environment and the Environment Agency.' *Environment, Risk and Safety Executive, Engineering Council*

▷ **SECTION 3. Item 7.** 'Observe what lead countries and companies are doing. Monitor green interest in public.' Head of Environmental Affairs

▷ **SECTION 3. Item 7.** 'R & D will offer opportunities unrealised before. This will decide the future trends and, my words earlier on the UNEP (elaborated above).' Environmental Researcher

▷ **SECTION 3. Item 7.** 'Produce better products that use fewer resources in production, distribution and use. Favour the use of new materials if they get the job done better. Favour lightweight packaging over recyclable packaging if both do the same job at the same cost. Source materials and production in places that have less strict environmental regulations you will be doing the people in those places a favour but continue to obey the principles of common law (see above). Do not support corrupt regimes. Do not buy or lease stolen land.' Assistant Director, Environment Unit, Institute of Economic Affairs

▷ **SECTION 3. Item 7.** 'Showing examples of competitive companies. Marketing and talking a lot.' Environmental Consultancy, Spain

▷ **SECTION 3. Item 7.** 'Keep up-to-date on trends in legislation and the markets by reaching journals/, newsletters and other publications. I would refer the examples of companies who have applied for this eco-label e.g. Hoover and Coop.' Business Service Manager, Environmental Consultancy

▷ **SECTION 3. Item 7.** 'We conduct market surveys on a regular basis. We have enquire if environmental products are important to them and or their clients. We have found that the specifiers (of products) would like to use environmentally friendly products as long as they do not cost any more.' *Packaging Manufacturer, Canada*

Additional comments and Recommendations:

▷ 'Germany, packaging and take back. Next stage would be entire take back for all products sold and the responsibility on the companies selling therefore, if they want to participate in an economy, they simply have to comply.' *University Ph.D. Researcher*

▷ 'Examples of Best Practice (all of the following have been sort-listed for, or won, the Environment Award for Engineers: Sainsbury's Environmental Management Team environmental management; Normalair-Garrett (GKN) environmental management and technology; BT environmental management and technology; South Staffordshire Water Company environmental management and technology; Cleveland Cascade Chutes technology; Rolls Royce Oil and Marine technology.' Environment, Risk and Safety Executive, Engineering Council

▷ 'No overall estimate of environmental impact is possible. Environmental audits tend to measure degree of compliance with regulations, but these regulations rarely have much to do with real environmental impact. Environmental improvements tend to come through autonomous technological change (such as the use of natural gas rather than coal to fire power stations). Regulatory-induced changes are often very expensive. Not all regulations are bad, of course, but it is difficult to know which are desirable and which repugnant. Other corporate environmental activities include such dubious actions as funding environmental pressure groups (who then put out ridiculous propaganda materials making all sorts of dubious claims about the coming apocalypse). One quite reasonable use of corporate funds is the creation of nature reserves and the sponsorship of projects such as CAMPFIRE. However, only a few companies actually engage in these activities, partly because few have departments responsible for charitable activities. In this regard, was particularly impressed by De Beer's game reserve in the Northern Transvaal.' Assistant Director, Environment Unit, Institute of Economic Affairs

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The survey took place over a period of nine months from March 1997 to December 1997. The piloted stage was for the period of four months - that includes the time for producing the web page design - between March 1997 to June 1997.

The main survey contacted for a period of five months between July 1997 to December 1997 (excluded August '97). The sample collected were 64 replies obtained from UK based packaging companies.

Table V.2. Section 1. - Personal views on business environmental debate

Survey Results indicating the number of respondents in each item and the percentage

Item 1 ***Do you believe that environmental issues are highly important in business operations?***

Value	Label	Score	Percentage
1	Very important	43	67.19%
2	Rather important	14	21.88%
3	Not very important	1	1.56%
4	Not at all important	6	9.38%

Comment: One respondent indicates that environmental issues are 'very important' for large companies and 'not at all important' for small companies. - *Design Counsultancy, Packaging Design*

Item 2 ***What do you believe are the main motivations for companies response in the environmental agenda?***

		Ethical investment/ responsibilities		Environmental legislation/ penalties		Consumer pressure / Green marketing		Codes of practice - EMAS/BS 7750/ISO 9000,14001		Competitive position from other business environmental initiatives		Environmental profit	
Value	Label	Score	%	Score	%	Score	%	Score	%	Score	%	Score	%
1	Agree strongly	6	9.38	38	59.38	8	12.50	7	10.94	2	3.13	8	12.50
2	Tend to agree	35	54.69	26	40.63	51	79.69	50	78.13	48	75.00	28	43.75
3	Tend to disagree	17	26.56	0	0.00	3	4.69	4	6.25	11	17.19	26	40.63
4	Disagree strongly	6	9.38	0	0.00	0	0.00	0	0.00	1	1.56	0	0.00
5	No answer					2	3.13	3	4.69	2	3.13	2	3.13

Other

- '*Culture pressure is important*' Business Service Manager, Environmental Counsultancy

Item 3 ***When did you first introduce environmental requirements on products and/or services?***

Value	Label	Score	Percentage	Value	Label	Score	Percentage
1	1975 or before	6	9.38%	8	1993	6	9.38%
2	1976 to 1980	5	7.81%	9	1994	13	20.31%
3	1981 to 1984	1	1.56%	10	1995	0	0.00%
4	1985 to 1987	8	12.50%	11	1996	5	7.81%
5	1988 to 1990	7	10.94%	12	Not yet	7	10.94%
6	1991	0	0.00%	13	No answer	3	4.69%
7	1992	3	4.69%				

Item 4 ***What proportion of information about environmental implications for business activities did you learn from the following sources?***

		College Studies		Conference		Exhibition		Journal/ Publications		Clients requirements	
Value	Label	Score	%	Score	%	Score	%	Score	%	Score	%
1	Always	1	1.56	1	1.56	0	0.00	7	10.94	6	9.38
2	75% of the time	2	3.13	5	7.81	10	15.63	33	51.56	10	15.63
3	50% of the time	9	14.06	24	37.50	18	28.13	10	15.63	25	39.06
4	25% of the time	8	12.50	12	18.75	12	18.75	14	21.88	1	1.56
5	Hardly ever	26	40.63	10	15.63	19	29.69	0	0.00	18	28.13
6	Never	18	28.13	12	18.75	5	7.81	0	0.00	4	6.25

Other

- 'Practical learning at work' Head of Environmental Affairs
- 'At work' commented by five: Head of Environmental Affairs; Environmental Affairs Co-ordinator, Paper Packaging; Environmental Manager, Corrugated Packaging; Head of Environmental Affairs; and Manager, Paper Packaging

Item 5 *Could you please explain what environmental practice means to you?*

Value	Label	Adopting environmental legislations and standards		Support community environmental relation programmes		Encourage customers to consider in depth the environmental implication of your business activities		Integrate environmental management in corporate level		Recognise environmental risks as part of the normal checklist of risk assessment & management		Checking your suppliers approach to environmental standards/official certificate		Giving environmental information to consumers in an ethical context	
		Score	%	Score	%	Score	%	Score	%	Score	%	Score	%	Score	%
1	Agree strongly	24	37.50	8	12.50	18	28.13	33	51.56	31	48.44	19	29.69	23	35.94
2	Tend to agree	38	59.38	38	59.38	32	50.00	24	37.50	33	51.56	34	53.13	28	43.75
3	Tend to disagree	0	0.00	13	20.31	13	20.31	5	7.81	0	0.00	10	15.63	13	13.00
4	Disagree strongly	2	9.38	2	3.13	1	1.56	1	1.56	0	0.00	1	1.56	0	0.00
5	No answer			3	4.69			1	1.56						

Comments: ***Adopting environmental legislations and standards***
If so, which one is in place now, in your company?
'Everybody' *Senior Engineer, Environmental Counsultancy*

- 'Satisfying our customers requirements.' *Sales Department, Packaging Design*
- 'Lots of different environmental regulations.' *Head of Environmental Affairs*
- 'Packaging waste legislation being implemented' *Packaging Manager, Toys Packaging*
- 'ISO 9002' *Manager*
- 'Producer Responsibility Obligations (Packaging Waste) Regulations 1997.' *Packaging Engineer*
- '14001' *Research Manager, Packaging Manufacturer*
- 'Paper recycling' *Researcher*
- 'Priorities in our customers requirements' *Packaging Design Innovation*
- 'Recycling legislation' *Manager, Packaging Manufacturer'*
- 'Packaging waste Directive' *Packaging Engineer, Paper Packaging*

Other

- 'Obeying common law principles; avoiding nuisance; compensating parties for harm inflicted. Producing goods in the most economically efficient way.' *Assistant Director, Environment Unit, Institute of Economic Affairs*
- 'Reducing your environmental impact.' *Business Service Manager, Environmental Consultant*

Table V.3. Section 2 - Corporate Environmental Profile

Survey Results indicating the number of respondents in each item and the percentage

Item 1 *When did your organisation start its initiatives to be environmentally responsible?*

Value	Label	Score	Percentage	Value	Label	Score	Percentage
1	1975 or before	12	18.75%	8	1993	0	0.00%
2	1976 to 1980	5	7.81%	9	1994	15	23.44%
3	1981 to 1984	1	1.56%	10	1995	0	0.00%
4	1985 to 1987	2	3.13%	11	1996	11	17.19%
5	1988 to 1990	10	15.63%	12	Not yet	1	1.56%
6	1991	0	0.00%	13	No answer	2	3.13%
7	1992	5	7.81%				

Item 2 *Does your organisation have an environmental policy?*

Value	Label	Score	Percentage	Value	Label	Score	Percentage
1	Always	29	45.31%	4	Hardly ever	12	18.75%
2	Nearly always	20	31.25%	5	Never	2	3.13%
3	Often	0	0.00%	6	No answer	1	1.56%

Item 2a. *When was the policy formally established?*

Value	Label	Score	Percentage	Value	Label	Score	Percentage
1	More than four years ago	33	51.56%	4	Last year	11	17.19%
2	Three years ago	12	18.75%	5	This year	1	1.56%
3	Two years ago	0	0.00%	6	No answer	7	10.94%

Item 3 *Could you please state what sort of environmental commitments the policy implies?*

		Compliance with legislation		Control environmental impact		Specific management aspect related with corporate policy systems		Particular area of organisation operation		Waste management audits	
Value	**Label**	**Score**	**%**	**Score**	**%**	**Score**	**%**	**Score**	**%**	**Score**	**%**
1	Always	56	87.50	30	46.88	16	25.00	18	28.13	13	20.31
2	75% of the time	0	0.00	5	7.81	22	34.38	12	18.75	10	15.63
3	50% of the time	1	1.56	22	34.38	6	9.38	10	15.63	1	1.56
4	25% of the time	5	7.81	6	9.38	1	1.56	12	18.75	12	18.75
5	Hardly ever	1	1.56	0	0.00	5	7.81	10	15.63	15	23.44
6	Never	1	1.56	1	1.56	12	18.75	0	0.00	12	18.75
7	No answer							2	3.13	1	1.56

		Suppliers audits		Quality Control audits		Verifying systems		Cost savings audits	
Value	**Label**	**Score**	**%**	**Score**	**%**	**Score**	**%**	**Score**	**%**
1	Always	24	37.50	17	26.56	12	18.75	11	17.19
2	75% of the time	0	0.00	6	9.38	1	1.56	11	17.19
3	50% of the time	6	9.38	15	23.44	20	31.25	12	18.75
4	25% of the time	6	9.38	12	18.75	12	18.75	11	17.19
5	Hardly ever	14	21.88	10	15.63	15	23.44	0	0.00
6	Never	12	18.75	3	4.69	3	4.69	18	28.13
7	No answer	2	3.13	1	1.56	1	1.56	1	1.56

Other, Please specify:

- 'Safe handling and application of products. Disposal of empty containers' *Packaging Consultancy*

Item 4 *Has you organisation changed its environmental policy over the last decade?*

Value	**Label**	**Score**	**Percentage**
1	Yes	24	37.50%
2	No	18	28.13%
3	Not sure	22	34.38%

If yes: **Item 4 a)** *Can you recall when it was?*

1. '1991' Head of Environmental Affairs
2. 'Yes, in 1994 to focus on Sustainable Business Development' Fine Papers Environmental Advisor
3. '6 years ago' Business Manager, President, Packaging Manufacturer Company
4. 'A progress of continuous improvement over the ten years period.' Packaging Consultancy
5. '1996' Packaging Manufacturer
6. '1996' Manager, Packaging Manufacturer
7. '1996' Packaging Construction
8. ' four years ago' Business Manager, Packaging Manufacturer

Item 4 a) *What was the principal catalyst for the change of policy?*

1. 'Merger' *Head of Environmental Affairs*
2. 'Better understanding of how future environmental pressures would affect business' *Fine Papers Environmental Advisor*
3. 'Moved the manufacturer operation.' *Business Manager, President, Packaging Manufacturer Company*
4. 'Pending legislation in many countries.' *Packaging Consultancy*
5. 'Waste legislation.' *Packaging Manufacturer*
6. 'New legislation and technology.' *Manager, Packaging Manufacture*
7. 'ISO 14001' *Packaging Construction*
8. 'Improved the manufacturing operation' *Business Manager, Packaging Manufacturer*

Item 5 *Which of the following describes best for you the term 'environmental audit'?*

	Value Label *1* Agree strongly		*Value* Label *2* Tend to agree		*Value* Label *3* Tend to disagree		*Value* Label *4* Disagree strongly	
	Score	**%**	**Score**	**%**	**Score**	**%**	**Score**	**%**
A management tool to control business environmental activities	16	25.00%	35	54.69%	12	18.75%	1	1.56%
An environmental process in corporate level	13	20.31%	28	43.75%	22	34.38%	1	1.56%
A business commitment to safeguard compliance with environmental legislation & standards	22	34.38%	35	54.69%	6	9.38%	1	1.56%
A way to talk and present companys' environmental performance	2	3.13%	34	53.13%	27	42.19%	1	1.56%
A format to check business environmental impact	18	28.13%	24	37.50%	21	32.81%	1	1.56%

Item 6 *Does your company hold environmental audits which address the impact of its whole operation?*

Value	Label	Score	Percentage
1	Always	12	18.75%
2	Nearly always	5	7.81%
3	75% of the time	0	0.00%
4	50% of the time	6	9.38%
5	25% of the time	12	18.75%
6	Hardly ever	20	31.25%
7	Never	9	14.06%

Item 6a *Could you please state how frequently does your company have environmental audits?*

Value	Label	Score	Percentage
1	One every year	12	18.75%
2	Once every two years	13	20.31%
3	One every three years	5	7.81%
4	Other	5	7.81%
5	No answer	29	45.31%

Other. Please be more specific:

- 'Three times/year' Paper Mill Company
- 'Depends on the legislation' Chief Designer, Packaging Manufacturer
- 'One every three years. Periodically in some aspects of operations. Never on an overall basis.' Business Manager, Packaging Manufacturer Company
- 'Info not available' Packaging Engineer
- 'Depends on the legislation/ periodically'stated by Fine Papers Environmental Advisor; Paper Company; Paper Environmental Advisor; Paper Company
- 'Audit frequency depends on the legislation' Chief Designer, Packaging; Packaging Designer, Packaging Manufacturer; Design Manager, Paper Packaging Manufacturer; Paper Packaging Manufacturer;
- 'Periodically depends on the legislation.' Manufacturer Packaging
- 'Not enough information available.' Packaging Designer, Toy Manufacturer; Packaging Engineer; Paper Packaging Manufacturer; Designer, Paper Packaging Manufacturer;

Item 7 *Does your company hold a particular audit for individual products or services?*

Value	Label	Score	Percentage
1	Always	10	15.63%
2	Nearly always	5	7.81%
3	75% of the time	8	12.50%
4	50% of the time	0	0.00%
5	25% of the time	0	0.00%
6	Hardly ever	12	18.75%
7	Never	28	43.75%
8	No answer	1	1.56%

Item 7a *Could you please state how frequently does your company have an environmental audit for products and/or services?*

Value	Label	Score	Percentage
1	One every year	12	18.75%
2	Once every two years	5	7.81%
3	One every three years	0	0.00%
4	Other	17	26.56%
5	Never	30	46.88%

Other. Please be more specific:

- 'Three times/Year' Paper Mill Company
- 'When we launch a new product, system.' Chief Designer, Packaging Manufacturer
- 'Info not available'Packaging Engineer
- 'Apply for new product introduction' Head of Design, Packaging Manufacturer; Packaging Designer, Packaging Manufacturer; President, Manufacturing Packaging; Head of Design, Paper Packaging Manufacturer

Item 8 *Which of the following difficulties do you most encounter when implementing an environmental audit review?*

		Difficulties to collect data		Difficulties to control the whole process		Difficulties to find the appropriate staff		Difficulties to cope with resources and costs involved		Clear guidelines not available	
Value	Label	Score	%	Score	%	Score	%	Score	%	Score	%
1	Always	29	45.31	22	34.38	11	17.19	22	34.38	11	17.19
2	Nearly always	1	1.56	1	1.56	12	18.75	1	1.56	12	18.75
3	Often	10	15.63	23	35.94	16	25.00	23	35.94	2	3.13
4	Hardly ever	16	25.00	10	15.63	16	25.00	5	7.81	21	32.81
5	Never	2	3.13	1	1.56	1	1.56	6	9.38	6	9.38
6	No answer	6	9.38	7	10.94	8	12.50	7	10.94	12	18.75

Other. Please state:

- 'No real experience' Packaging Manufacturer Company
- 'No clear EI comparisons for industry. We need a large order of magnitude more in research to assess what the EI of the actions and products we buy are.' Environmental Researcher

Table V.4. Section 3 - Environmental Management approach

Survey Results indicating the number of respondents in each item and the percentage

Item 1 *How does your company carry out its environmental activities?*

	Value Label 1 Very likely		*Value* Label 2 Likely		*Value* Label 3 Unlikely		*Value* Label 4 Very unlikely		*Value* Label 5 No answer	
We employ an external environmental consultant	Score 7	% 10.94%	Score 10	% 15.63%	Score 21	% 32.81%	Score 26	% 40.63%	Score	%
We have an environmental team in place	23	35.94%	7	10.94%	10	15.63%	23	35.94%	1	1.56%
We collaborate with external environmental auditors	17	26.56%	26	40.63%	9	14.06%	8	12.50%	4	6.25%
We collaborate with independent governmental bodies/verifiers	24	37.50%	28	43.75%	0	0.00%	12	18.75%	1	1.56%

Other Please state:

▷ 'We are just forming an environmental management team.' Business Manager, President, Packaging Manufacturer Company

Item 2 *Does your company present its environmental activities performance?*

Value	Label	Score	Percentage
1	Always	11	17.19%
2	Nearly always	6	9.38%
3	Often	21	32.81%
4	Hardly ever	16	25.00%
5	Never	10	15.63%

Item 2a *If your company is presenting its environmental performance, could you please state to which of the following groups?*

		Stakeholders		Board of Directors		Employees		Governmental Bodies		Interested parties		General public	
Value	Label	Score	%	Score	%	Score	%	Score	%	Score	%	Score	%
1	Always	26	40.63	38	59.38	2	34.38	15	23.44	10	15.63	14	21.88
2	75% of the time	5	7.81	5	7.81	20	31.25	6	9..38	6	9.38	5	7.81
3	50% of the time	6	9.38	4	6.25	0	0.00	20	31.25	13	20.30	16	25.00
4	25% of the time	11	17.19	6	9.38	5	7.81	0	0.00	6	9.38	0	0.00
5	Hardly ever	5	7.81	0	0.00	6	9.38	5	7.81	15	23.44	1	1.56
6	Never	1	1.55	1	1.55	1	1.55	8	12.49	4	6.25	17	26.56
7	No answer	10	15.63	10	15.63	5	15.63	10	15.63	10	15.63	11	17.19

Item 3 *Does your company publish an environmental review statement?*

Value	Label	Score	Percentage
1	Always	21	32.81%
2	Nearly always	1	1.56%
3	Often	11	17.19%
4	Hardly ever	5	7.81%
5	Never	26	40.63%

Item 4 *What is the format of the presented information?*

	Value Label 1 Always		*Value* Label 2 Nearly always		*Value* Label 3 Often		*Value* Label 4 Hardly ever		*Value* Label 5 Never		*Value* Label 6 No answer	
Environmental report	Score 21	% 32.81	Score 0	% 0.00	Score 1	% 1.56	Score 6	% 9.38	Score 0	% 0.00	Score 36	% 56.25
Leaflet	5	7.81	5	7.81	18	28.13	5	7.81	0	0.00	31	48.44
Fact sheet for individual products or particular activities	0	0.00	15	23.44	6	9.38	10	15.63	5	7.81	28	43.75

Item 5 *How often you report environmental activities?*

Not Reporting		**27**
Reporting		**37**
Sequence	**Format**	
Every three years	*Environmental Report to public*	2
Annual	*Annual Report*	29
Annual - New Product Literature	*Environmental leaflet*	4
Monthly	*Report*	4
Quarterly	*Board of Directors Report*	1
Every two - three years	*Environmental leaflet*	1
Bi-Monthly	*Company Newsletter*	9

Additional Comment:: 'Info not available.' *Packaging Engineer, Packaging Paper Company*

Item 6. *Is it possible to send me a copy of your environmental report or other environmental statement publications?*

Value	Label	Score	
1	Yes	17	
2	No	20	
3	Not any	27	**Total Reports received: 17**

Additional Comment: 'Not without first obtaining permission from our clients.' *Packaging Consultancy*

Item 7. Your Own View: *How can companies anticipate and plan for future trends on environmental product development?*

- 'All our products are paper based 100% recyclable and recycled, monitor trade journal environmental reporting, monitor/ Respond to our blue chip customer requirements/ Design 'weight' out of packaging and volume to cut costs in piece prices / Transportation/ Recovery and recycling. Design packaging away from non- environmental materials i.e. EPS (Expanded polystyrene), foams etc. made from non renewable materials. Although companies agree in general to the ethic responsibilities towards the environment, they want to be seen to be doing right but also save packaging costs We can usually design cost out successfully. Some legislation has led companies paying more for packaging to meet standards but this is the minority in the packaging industry at present.' Chief Designer, Packaging Manufacturer
- 'Forums and conferences with closer planning this action plans.' Toys Packaging Business
- 'With financial aid and assistance from government agencies' Packaging Design Innovation
- 'Examine environmental projects to 2010/2020 and work out a 'sustainable business' strategy.' Fine Papers Environmental Adviser
- 'Hasbro as many branches in other countries and changes in attitudes in this country can usually be detected earlier in other countries such as Germany or US.' Packaging Engineer, Toy Manufacturer
- 'The views expressed reflect the past and current situation in our project work for clients.' Proprietor, Packaging Consultancy
- 'Examination of raw material, safety information approvals through the European legislation.' Research Manager, Packaging Manufacturer
- 'By participating in the decision making, lobbying, and shaping process.' Packaging Consultancy

Table IX.4. Section 4. - Demographics of the subjects'

Business activity

Value	Label	Score	Percentage
1	Consultancy	10	15.63%
2	Packaging design	10	15.63%
3	Paper & board supplier	2	3.13%
4	Paper & packing manufacturer	35	54.69%
5	Other	7	10.94%

Number of employees

Value	Label	Score	Percentage	Value	Label	Score	Percentage
1	1-49	10	15.63%	5	500-1000	4	6.25%
2	50-99	19	29.69%	6	1000+	15	23.44%
3	100-249	8	12.50%	7	No answer	2	3.13%
4	250-499	6	9.38%				

Turnover

Value	Label	Score	Percentage	Value	Label	Score	Percentage
1	Under £1 million	1	1.56%	5	£26-£50 million	4	6.25%
2	£1-£5 million	9	14.06%	6	£51-£100 million	0	0.00%
3	£6-£10 million	27	42.19%	7	Over £100 million	15	23.44%
4	£11-£25 million	5	7.81%	8	No answer	3	4.69%

	Item 1 *Do you want to remain anonymous?*	**Item 2** *Do you wish to be informed about the results of the survey?*	**Item 3** *Are you willing to co-operate again during the process of the research?*
Label	Score	Score	Score
Yes	61	53	48
No	2	10	16
No answer	1	1	

Table V.5. Principal Investigation *Second Survey* Data Results

	Candidate	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Section 1.	Item 1.	4	1	2	1	3	1	2	1	1	1	1	2	1	2	1	1	1	1	4	2	2	2
	Item 2.a	3	3	3	2	4	2	2	2	2	2	3	1	3	1	2	2	2	2	4	1	2	2
	Item 2.b	1	1	1	2	1	2	2	1	1	2	2	2	2	1	1	1	1	2	2	2	2	2
	Item 2.c	2	2	2	2	2	2	2	2	2	1	1	3	2	2	2	2	1	2	2	3	2	2
	Item 2.d	2	2	2	5	2	3	1	2	2	2	2	3	2	2	1	2	2	1	2	3	1	1
	Item 2.e	2	2	2	1	3	4	2	2	2	3	1	3	2	2	2	2	2	2	3	3	2	2
	Item 2.f	2	2	2	3	2	1	2	1	3	3	1	3	3	2	3	2	3	1	2	3	2	2
	Item 3.	9	9	7	13	12	4	11	1	8	4	8	5	2	12	9	5	12	1	3	5	11	11
	Item 4.a	5	5	3	5	1	4	6	4	4	5	4	5	3	2	4	6	6	5	2	5	6	6
	Item 4.b	3	3	5	4	5	4	6	4	2	6	4	5	3	1	4	3	3	3	4	5	6	6
	Item 4.c	2	2	5	5	5	4	5	6	4	3	5	5	4	3	4	3	3	3	5	5	5	5
	Item 4.d	1	2	2	2	1	1	2	4	2	2	4	2	4	2	2	3	3	2	4	2	2	2
	Item 4. e	5	3	3	3	5	4	2	1	3	3	5	5	5	3	3	1	3	2	5	5	2	2
	Item 5.a	1	2	2	2	4	4	2	1	1	2	2	2	2	1	1	1	2	1	1	2	2	2
	Item 5.b	2	2	3	4	4	3	3	2	2	1	2	2	2	1	3	1	2	1	2	2	5	3
	Item 5. c	1	2	3	3	4	3	2	2	2	1	3	2	1	2	1	3	2	2	1	2	2	2
	Item 5. d	1	2	2	2	4	2	2	1	1	2	1	1	1	1	1	3	1	2	5	1	2	2
	Item 5. e	1	1	2	2	1	2	2	1	2	2	1	1	1	2	1	2	1	1	1	1	2	2
	Item 5. f	2	2	3	2	4	2	3	2	2	2	1	1	2	2	1	1	1	1	1	1	3	3
	Item 5. g	1	2	3	3	2	3	3	2	2	1	1	1	2	3	2	2	1	2	1	1	3	3
Section 2.	Item 1.	9	9	7	13	12	4	11	1	9	1	5	5	2	11	9	5	11	1	3	4	11	11
	Item 2	2	2	4	5	5	1	2	1	1	1	1	4	1	4	1	1	2	1	4	4	2	2
	Item 2. a	2	2	6	6	6	5	4	1	1	1	1	1	1	4	2	1	4	1	1	1	4	4
	Item 3. a	1	1	1	1	6	1	4	1	1	1	1	1	1	3	1	1	1	1	5	1	4	4
	Item 3. b	1	3	3	3	6	1	4	1	1	1	1	3	2	3	1	1	3	1	4	3	4	4
	Item 3. c	2	2	1	7	7	6	5	2	1	3	6	6	2	2	1	1	6	2	4	6	5	5
	Item 3. d	1	2	5	7	7	1	4	3	1	4	1	3	2	2	1	1	5	2	4	3	4	4
	Item 3. e	6	6	5	6	7	1	4	2	1	4	6	5	2	3	1	1	5	1	4	5	4	4
	Item 3. f	6	6	5	6	7	6	1	4	1	1	6	5	3	3	1	1	5	1	4	5	1	1
	Item 3. g	5	5	3	6	7	6	2	1	1	3	6	4	3	2	1	1	4	1	4	4	2	2
	Item 3. h	5	5	3	6	7	6	3	3	1	4	6	5	3	2	1	1	4	1	4	5	3	3
	Item 3. i	6	6	3	6	7	6	2	3	1	4	6	6	4	3	1	1	2	2	3	6	2	2
	Item 4	2	3	3	3	2	2	2	1	1	2	1	1	1	1	1	1	3	2	3	1	2	2
	Item 5. a	1	2	2	2	4	2	3	2	2	2	1	2	1	3	2	1	3	2	3	2	3	3
	Item 5. b	1	2	2	2	4	3	2	2	3	3	1	1	2	2	2	3	3	1	3	1	2	2
	Item 5. c	1	2	2	2	4	3	2	1	2	2	1	1	2	2	2	1	2	1	2	1	2	2
	Item 5. d	3	3	3	2	4	1	2	2	3	2	3	3	2	2	2	2	2	2	2	3	1	2
	Item 5. e	3	3	3	2	4	1	2	1	2	3	1	2	2	1	1	2	1	2	1	2	2	2
	Item 6.	5	6	7	7	7	5	5	6	1	4	7	6	2	5	1	1	6	1	7	6	5	5
	Item 6. a	5	5	5	5	5	2	1	5	4	2	5	3	2	2	1	1	5	1	5	3	1	1
	Item 7.	6	7	7	7	8	7	3	1	7	6	6	7	2	3	3	1	7	3	7	7	3	3
	Item 7. a	5	5	5	5	5	5	1	4	4	4	4	5	2	5	1	1	5	1	5	5	1	1
	Item 8. a	1	1	6	1	5	1	3	1	4	4	5	4	3	6	1	1	1	2	1	4	3	3
	Item 8. b	1	1	6	1	5	2	3	3	4	3	6	3	4	6	3	1	1	3	1	3	3	3
	Item 8. c	2	2	6	2	6	2	3	4	4	5	6	3	4	6	4	1	1	3	1	3	3	3
	Item 8. d	1	1	6	1	5	2	3	3	5	3	6	3	4	6	3	1	1	3	1	3	3	3
	Item 8. e	2	2	6	2	5	2	6	4	5	4	6	4	4	6	4	1	1	4	1	4	6	6
Section 3.	Item 1. a	2	2	3	4	1	4	4	3	4	4	3	3	3	4	4	1	4	1	4	3	4	4
	Item 1. b	2	2	4	4	1	2	4	1	1	4	1	3	1	5	1	1	3	1	4	3	4	4

Appendix V

Data and Statistics from Second Survey

Item 1. c	1	2	2	5	1	2	4	2	1	2	2	3	2	2	2	1	3	1	4	3	4	4
Item 1. d	1	1	2	2	1	4	4	2	1	2	1	1	2	2	2	1	4	1	4	2	4	4
Item 2.	3	3	5	5	5	5	4	2	1	3	5	4	3	4	1	1	4	2	5	4	4	4
Item 2.aa	1	1	6	6	6	6	5	2	1	4	6	1	3	3	6	1	4	1	6	1	5	5
Item 2.ab	1	1	6	6	6	6	4	2	1	1	6	1	1	4	6	1	3	1	6	1	4	4
Item 2.ac	2	2	6	6	6	6	4	2	1	1	6	5	1	5	6	1	2	1	6	5	4	4
Item 2.ad	3	3	6	6	6	6	5	3	1	6	6	1	2	6	6	1	3	2	6	1	5	5
Item 2.ae	3	3	6	6	6	6	5	2	1	4	6	5	3	5	6	1	3	2	6	5	5	5
Item 2. af	3	7	6	6	6	6	6	2	1	6	6	6	3	5	7	1	3	3	6	6	6	6
Item 3.	3	4	5	5	5	5	5	1	1	3	5	5	1	5	1	1	5	2	5	5	5	5
Item 4. a	6	6	6	6	6	6	6	1	1	4	6	6	1	6	6	1	6	3	6	6	6	6
Item 4. b	3	3	6	6	6	6	6	2	3	3	6	6	4	6	6	1	6	3	6	6	6	6
Item 4. c	2	2	6	6	6	6	6	4	2	3	6	6	4	6	6	6	5	6	4	6	6	6
Section 4. Activity	1	1	4	2	5	1	2	5	4	4	5	4	2	4	4	5	4	4	5	4	2	2
No empl.	2	2	2	2	7	2	1	6	6	3	2	4	1	2	7	4	6	3	3	4	1	1
Turnover	3	3	3	3	8	3	2	7	7	3	3	4	1	8	8	3	7	5	3	4	2	2

Candidate	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**
Section 1. Item 1.	4	1	2	1	2	1	1	4	1	1	1	4	1	2	4	1	2	1	1	1	1
Item 2.a	3	2	2	2	2	2	4	3	2	4	2	3	2	3	3	4	3	2	4	2	3
Item 2.b	1	1	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Item 2.c	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Item 2.d	2	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Item 2.e	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Item 2.f	2	1	2	1	2	1	2	2	1	2	3	2	3	2	2	2	2	3	2	3	2
Item 3.	9	1	11	1	11	1	9	9	1	9	8	9	8	9	9	9	9	8	9	8	7
Item 4.a	5	3	6	4	6	4	5	5	4	5	5	5	5	6	5	5	6	5	5	5	3
Item 4.b	3	4	6	4	6	4	4	3	3	4	3	2	3	2	5	3	3	5	2	3	2
Item 4.c	2	6	5	6	5	6	2	2	6	2	4	2	4	5	2	2	5	4	2	4	5
Item 4.d	1	4	2	4	2	4	2	1	4	2	2	1	4	4	1	2	2	2	2	2	2
Item 4. e	5	6	2	6	2	6	2	5	6	2	3	5	3	3	5	2	3	3	2	3	3
Item 5.a	1	1	2	1	2	1	2	1	1	2	1	1	1	2	1	2	2	1	2	1	2
Item 5.b	2	2	3	2	3	2	2	2	2	2	2	2	2	5	2	2	5	2	2	2	3
Item 5. c	1	2	2	2	2	2	2	1	2	2	2	1	2	3	1	2	3	2	2	2	3
Item 5. d	1	1	2	1	2	1	2	1	1	2	1	1	1	2	1	2	2	1	2	1	2
Item 5. e	1	1	2	1	2	1	2	1	1	2	2	1	2	2	1	2	2	2	2	2	2
Item 5. f	2	2	3	2	3	2	2	2	2	2	2	2	2	3	2	2	2	3	2	2	3
Item 5. g	1	2	3	2	3	2	2	1	2	2	2	1	2	3	1	1	2	3	2	2	3
Section 2. Item 1.	9	1	11	1	11	1	9	13	1	9	9	9	9	7	9	9	9	7	9	9	7
Item 2	2	1	2	1	2	1	2	2	1	2	1	2	1	4	2	2	4	1	2	1	4
Item 2. a	2	1	4	1	4	1	2	2	1	2	1	2	1	6	2	2	6	1	2	2	6
Item 3. a	1	1	4	1	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Item 3. b	1	1	4	1	4	1	3	1	1	3	1	1	1	3	1	3	3	1	3	1	3
Item 3. c	2	2	5	2	5	2	2	2	2	2	1	2	1	1	2	2	1	1	2	1	1
Item 3. d	1	3	4	3	4	3	2	1	3	2	1	1	1	5	1	2	5	1	2	1	5
Item 3. e	6	2	4	2	4	2	6	6	2	6	1	6	1	5	6	6	5	1	6	1	5
Item 3. f	6	4	1	4	1	4	7	6	4	6	1	6	1	5	6	6	5	1	6	1	5
Item 3. g	5	1	2	1	2	1	5	5	1	5	1	5	1	3	5	5	3	1	5	1	3
Item 3. h	5	3	3	3	3	3	5	5	3	5	1	5	1	3	5	5	3	1	5	1	3
Item 3. i	6	3	2	3	2	3	6	6	3	6	1	6	1	3	6	6	3	1	6	1	3
Item 4	2	3	2	3	2	3	3	2	3	3	1	2	1	3	2	3	3	1	3	1	3
Item 5. a	1	2	3	2	3	2	2	1	2	2	2	1	2	2	1	2	2	2	2	2	2

Item 5. b	1	2	2	2	2	2	2	1	2	2	3	1	3	2	1	2	2	3	1	2	2
Item 5. c	1	1	2	1	2	1	2	1	1	2	2	1	2	2	1	2	2	2	2	2	2
Item 5. d	3	2	2	2	2	2	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3
Item 5. e	3	1	2	1	2	1	3	3	1	3	2	3	2	3	3	3	3	2	3	2	3
Item 6.	5	6	5	6	5	6	6	5	6	6	1	5	1	7	5	6	7	1	6	1	7
Item 6. a	5	6	1	6	1	6	5	5	6	5	4	5	4	5	5	5	5	4	5	4	2
Item 7.	6	1	3	1	3	1	7	6	1	7	7	6	7	7	6	7	7	7	7	7	7
Item 7. a	5	4	1	4	1	4	5	5	4	5	4	5	4	5	5	5	5	4	5	4	5
Item 8. a	1	1	3	1	3	1	1	1	1	1	4	1	4	6	1	1	6	4	1	4	6
Item 8. b	1	3	3	3	3	3	1	1	3	1	4	1	4	6	1	1	6	4	1	4	6
Item 8. c	2	4	3	4	3	4	2	2	4	2	4	2	4	6	2	2	6	4	2	4	6
Item 8. d	1	3	3	3	3	3	1	1	3	1	5	1	5	6	1	1	6	5	1	5	6
Item 8. e	2	4	6	4	6	4	2	2	4	2	5	2	5	6	2	2	6	5	2	5	6
Section 3. Item 1. a	2	3	4	3	4	3	2	2	3	2	4	2	4	3	2	2	3	4	2	4	3
Item 1. b	2	1	4	1	4	1	4	2	1	4	1	2	1	4	2	4	4	1	4	4	4
Item 1. c	1	2	4	2	4	5	5	1	5	2	1	1	1	4	1	2	4	1	2	1	2
Item 1. d	1	2	4	2	4	2	1	1	2	1	1	1	1	2	1	1	2	1	1	1	2
Item 2.	3	2	4	2	4	2	3	3	2	3	1	3	1	5	3	3	5	1	3	1	5
Item 2.aa	1	2	5	2	5	2	1	1	2	1	1	1	1	7	1	1	7	1	1	1	7
Item 2.ab	1	2	4	2	4	2	1	1	2	1	1	1	1	7	1	1	7	1	1	1	7
Item 2.ac	2	2	4	2	4	2	2	2	2	2	1	2	1	7	2	2	7	1	2	1	7
Item 2.ad	3	3	5	3	5	3	3	3	3	3	1	3	1	7	3	3	7	1	3	1	7
Item 2.ae	3	2	5	2	5	2	7	3	2	7	1	3	1	7	3	7	7	1	3	1	7
Item 2. af	3	2	6	2	6	2	7	3	2	7	1	3	1	7	3	7	7	1	7	7	7
Item 3.	3	1	5	1	5	1	4	3	1	4	1	3	1	5	3	4	5	1	4	1	5
Item 4. a	6	1	6	1	6	1	6	1	6	1	6	1	6	6	6	6	1	6	1	1	6
Item 4. b	6	2	6	2	6	2	3	6	2	3	3	6	3	6	6	3	6	3	3	3	6
Item 4. c	2	4	6	4	6	4	2	2	6	2	2	2	2	6	2	2	6	2	2	2	6
Section 4. Activity	1	5	2	4	2	4	1	1	5	1	3	1	4	4	1	3	4	4	1	4	4
No empl.	2	6	1	6	1	6	2	2	6	2	6	2	6	2	2	2	2	6	2	6	2
Turnover	3	7	2	7	2	7	3	3	7	3	7	3	7	3	3	3	3	7	3	7	3

Canditate	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**	**61**	**62**	**63**	**64**
Section 1. Item 1.	1	1	1	1	2	1	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1
Item 2.a	2	3	2	2	1	2	1	2	1	3	2	2	3	2	2	2	3	2	2	3	2
Item 2.b	2	1	2	2	2	2	2	2	2	2	1	1	2	1	2	2	1	1	2	1	1
Item 2.c	1	2	1	1	5	1	5	1	3	2	2	2	2	2	2	2	2	2	2	2	2
Item 2.d	2	2	2	2	5	2	5	2	3	2	2	2	2	2	2	2	2	2	2	2	2
Item 2.e	3	2	3	3	5	3	5	3	3	2	2	2	2	2	2	2	2	2	2	2	2
Item 2.f	3	2	3	3	5	3	5	3	3	3	2	3	3	3	2	3	2	3	3	2	3
Item 3.	4	7	4	4	13	4	13	4	5	2	4	12	2	12	5	2	5	12	2	5	12
Item 4.a	5	3	5	5	6	5	5	5	5	3	6	6	3	6	6	3	6	6	3	6	6
Item 4.b	5	6	5	6	6	6	6	5	6	5	3	3	3	3	4	3	3	3	3	3	3
Item 4.c	3	5	3	3	5	3	5	3	5	4	3	3	4	3	3	4	3	3	4	3	3
Item 4.d	2	2	2	2	2	2	2	2	2	4	3	3	4	3	3	4	3	3	4	3	3
Item 4. e	3	3	3	3	5	3	5	3	5	5	1	3	5	3	1	5	1	3	5	1	3
Item 5.a	2	2	2	2	2	2	2	2	2	2	1	2	2	2	1	2	1	2	2	1	2
Item 5.b	2	3	2	2	2	2	2	2	2	2	3	2	2	1	3	2	3	1	2	3	1
Item 5. c	1	3	1	1	2	1	2	1	2	1	3	1	1	2	3	1	3	2	1	3	2
Item 5. d	2	2	2	2	1	2	1	2	1	1	3	2	1	1	3	1	3	1	1	3	1
Item 5. e	2	2	2	2	1	2	1	2	1	1	2	1	1	1	2	1	2	1	1	2	1
Item 5. f	2	3	2	2	1	2	1	2	1	2	1	1	2	1	1	2	1	1	2	1	1

Data and Statistics from Second Survey

	Item 5. g	1	3	1	1	1	1	1	1	1	2	2	1	2	1	2	2	2	1	2	2	1
Section 2.	Item 1.	1	7	1	1	5	1	5	1	5	2	5	11	2	11	5	2	5	11	2	5	11
	Item 2	1	4	1	1	4	1	4	1	4	1	1	2	1	2	1	1	1	2	1	6	2
	Item 2. a	1	6	1	1	1	1	1	1	1	1	1	4	1	4	1	1	1	4	1	1	4
	Item 3. a	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Item 3. b	1	3	1	1	3	1	3	1	3	2	1	3	2	3	1	2	1	3	2	1	3
	Item 3. c	3	1	3	3	6	3	6	3	6	2	1	6	2	6	1	2	1	6	2	1	6
	Item 3. d	4	5	4	4	3	4	3	4	3	2	1	5	2	5	1	2	1	5	2	1	5
	Item 3. e	4	5	4	4	5	4	5	4	5	2	1	5	2	5	1	2	1	5	2	1	5
	Item 3. f	1	5	1	1	5	1	5	1	1	5	3	1	5	3	5	1	3	1	3	1	5
	Item 3. g	3	3	4	3	4	3	4	3	4	3	1	4	3	4	1	3	1	4	3	1	4
	Item 3. h	4	3	4	4	5	4	5	4	5	3	1	4	3	4	1	3	1	4	3	1	4
	Item 3. i	4	3	4	4	6	4	6	4	6	4	1	2	4	2	1	4	1	2	4	1	2
	Item 4	2	3	2	3	1	2	1	2	1	1	1	3	1	3	1	1	1	3	1	1	3
	Item 5. a	2	2	2	2	2	2	2	2	2	1	1	3	1	3	1	1	1	3	1	1	3
	Item 5. b	3	2	3	3	1	3	1	3	1	2	3	3	2	3	3	2	3	3	2	3	3
	Item 5. c	3	2	3	3	1	3	1	3	1	2	1	2	2	2	1	2	1	2	2	1	2
	Item 5. d	2	3	2	2	3	2	3	2	3	2	2	2	2	2	2	2	2	2	2	2	2
	Item 5. e	3	3	3	3	1	3	1	3	1	2	1	2	2	2	1	2	1	2	2	1	2
	Item 6.	4	7	4	4	6	4	6	4	6	2	1	6	2	6	1	2	1	6	2	1	6
	Item 6. a	5	2	2	3	2	3	2	3	2	1	5	2	5	1	2	1	5	2	1	5	5
	Item 7.	6	7	6	6	7	6	7	6	7	2	1	7	2	7	1	2	1	7	2	1	7
	Item 7. a	4	5	4	4	5	4	5	4	5	2	1	5	2	5	1	2	1	5	2	1	6
	Item 8. a	4	6	4	4	4	4	4	4	4	3	1	1	3	1	1	3	1	1	3	1	1
	Item 8. b	3	6	3	3	3	3	3	3	3	4	1	1	4	1	1	4	1	1	4	1	1
	Item 8. c	3	6	3	3	3	3	3	3	3	4	1	1	4	1	1	4	1	1	4	1	1
	Item 8. d	3	6	3	3	3	3	3	3	3	4	1	1	4	1	1	4	1	1	4	1	1
	Item 8. e	4	6	4	4	3	4	3	4	4	4	1	1	4	1	1	4	1	1	4	1	1
Section 3.	Item 1. a	4	3	4	4	3	4	3	4	3	3	1	4	3	4	1	3	1	4	3	1	4
	Item 1. b	4	4	4	4	3	4	3	4	3	1	1	3	1	3	1	1	1	3	1	1	3
	Item 1. c	2	2	2	2	3	2	3	2	3	2	1	3	2	3	1	2	1	3	2	1	2
	Item 1. d	2	2	2	2	2	2	2	2	2	2	1	4	2	4	1	2	1	4	2	1	4
	Item 2.	3	5	3	3	4	3	4	3	4	3	1	4	3	4	1	3	1	4	3	1	4
	Item 2.aa	4	7	4	4	1	4	1	4	1	3	1	4	3	4	1	3	1	4	3	1	4
	Item 2.ab	1	7	1	1	1	1	1	1	1	1	1	3	1	3	1	1	1	3	1	1	1
	Item 2.ac	1	7	1	1	5	1	5	1	5	1	1	2	1	2	1	1	1	2	1	1	2
	Item 2.ad	6	7	6	6	1	6	1	6	1	2	1	3	2	3	1	2	1	3	2	1	3
	Item 2.ae	4	7	4	4	5	4	5	4	5	5	1	3	5	3	1	5	1	3	5	1	3
	Item 2. af	1	7	1	1	6	1	6	1	6	3	1	3	3	3	1	3	1	3	3	1	3
	Item 3.	3	5	3	3	5	3	5	3	5	1	1	5	1	5	1	1	1	5	1	1	5
	Item 4. a	4	6	4	4	4	4	4	4	4	1	1	6	1	6	1	1	1	6	1	1	6
	Item 4. b	3	6	3	3	4	3	4	3	4	4	1	6	4	6	1	4	1	6	4	1	6
	Item 4. c	3	6	3	3	3	3	4	3	4	4	5	6	4	6	5	4	5	6	4	5	6
Section 4.	Activity	4	4	4	4	4	4	4	4	4	2	4	4	2	4	4	4	4	4	2	4	4
	No empl.	3	2	3	3	4	3	4	3	4	1	5	6	1	6	5	1	5	6	1	5	6
	Turnover	3	3	3	3	3	3	4	3	4	2	4	7	2	7	5	2	5	7	2	5	7

Evolutionary prototyping
Model testing Interviews checklist and content analysis

At the *Testing and Evaluation Stage* two phases of evaluation of the EMCS *model* took place. The first phase was the evaluation of the five formats of the models with emphasis in evaluating and exploring the options suggested for improvements for the EMCS *model* based on the findings from the ***Investigation Stage.*** At the second evaluation phase the revised format of the EMCS *model* tested and modified.

Table VI.1 Instrument used in Models Evaluation - *1st Phase*

At the first evaluation phase of the EMCS *model* eleven subjects interviewed by face-to-face. Those subjects in the analysis follows are classified as **A.** respondents before the numerical value corresponding to the number of subject. In addition three *Elite* interviews took place from those one group interview - those subjects are classified as **B.** respondents for the purpose of the contents analysis.

At this phase of models testing - *evolutionary prototyping* - the questionnaire design applied to evaluation of the EMCS model and the suggested options for improvements from the previous research stage. However the other formats of the model placed in a file and displayed to the participants during the session.

This evaluation took place from June 1997 to November 1997. The interview schedule were as follows.

SECTION 1. **Introduction - *Models Testing***

The aims of the Ph.D. research and the scope of the interview explained to the potential respondent by phone and a day and time for the interviewed have been confirmed. Prior to the interview the evaluation questionnaire sent by post or by fax to the prospect interviewer. The materials were accompanied with a covering letter that summarised the aims of the interview and remind the day and time of the interview that had been arranged a page with a project description was also included. In addition, it was acknowledged the participants willingness to co-operate with the research, promised them that confidentiality will kept at any time and that the information provided will be used for academic purposes. Moreover, to motivate the interviewers to participate it promised to be informed about the progress of the research and the outcomes if it was of their interest.

SECTION 2. **Personal Details of the subject - *Models Testing***

This section completed by the research prior to the interview. The analysis include the position of the interviewer, the business activity/ type of the organisation and the location where the interview took place.

SECTION 3. **Attitude Questionnaire - *Models Testing***

1) Are you familiar with the terminology used?
   1a) Does the terminology describe adequately the stages indicated?
   1b) Do you believe that the terminology should be borrowed from ISO 14000?

2) Is the EMCS model self explanatory from one stage to another?
   2a) Do you understand the directions and the links provided?
   2b) Please state if something is missing or not described adequately.

3) Do you think there is enough information and direction provided?
   3a) Do you believe that additional information to explain in details the process to be followed should included in the format of the model or should provided in a complimentary document?

4) Do you believe that the final synthesis of the EMCS model should appear in a more simplified format? 4a) How do you perceive the idea of using a main simple model accompanied by sub-models that explain in more detail the stages of environmental analysis to be followed?

5) Please give your thoughts on the use of the sub-models for internal and external communication?

6) Do you find the EMCS model to have a practical application for packaging businesses?

7) Who do you believe could use the model?
a) Environmental manager *within the company* b) Environmental Consultancy *external*
c) Environmental auditor (internal or external) d) Head of Design/ Design Manager
e) Design Consultancy f) Other. (Please specify)

8) Do you find any of the elements from the previous formats of the model prototyping to be useful for inclusion at the final format of the EMCS model?

9) Do you have any suggestions for inclusion on the final model?
9a) Do you have any comments on the research project?

Table VI.2.: Content analysis of data collected from face-to-face evaluation *Attitudes Questionnaire* - 1st Phase *Models testing*

COMMUNICATION - USER UNDERASTANDING

+	The information material used in the presentation and the format of the different models regarded very interesting and of very good quality. The format of the EMCS is the best interpretation of model prototyping compared with the other five formats of models. The EMCS model provides clear directions and useful information material.
-	The amount of information included can be regarded more than necessary.

PERFORMANCE - EFFECTIVNESS IN USE/ PRACTICALITY

+	The EMCS model presents a very good interpretation of the stages of environmental analysis to be followed. The EMCS model has potentials for practical application. The directions on the EMCS model are of good interpretation - *clear and easy to follow.* The use of sub-models is very useful, practical and a very good concept.

OTHER LACKING DETAILS

-	Considered the use of existing terminology where applicable. Reduced the amount of the information provided - *keep the most essential points.*

SUMMARY OF SUGGESTIONS FOR IMPROVEMENTS

Make it more easy to follow by simplify links/directions from one stage to another.
Use a simplify format of a main model and incorporate in the sub-models more details for the stages of environmental analysis to be followed.
Borrow terminology from the ISO 14000 when it described the same process.
Use an accompanying document that explains in detail the directions to be followed in support of the structure of the model.

SPECIAL CONSIDERATIONS

The interpretation of the final model should be closely related with the ISO 14000.
The subsidiary models should provide information about: environmental auditing methodology; environmental responsibilities at internal and external level of business operation; design activities related to the ecological design characteristics and design management process.

A1. The subject found the presented material of good quality and the EMCS *model* the prototype with the most potential to be adopted. He found that the EMCS *model* provides clear directions and the links from one stage to another are very direct. He also found useful the information presented and efficient the structure of the *model*. The subject was also positive in the use of sub-models in support of the main model. However, he found that the model will be improved if the presented information reduced to the minimum required to bring the message across. He commented that the use of terminology from ISO 14000 will improve the effectiveness of the model for a practical application. In particular, he suggested

the replacement of the wording 'audit' with the wording 'environmental audit' and he mentioned that the sub-models should describe: the environmental auditing methodology; environmental responsibilities at internal and external level of business operation; and design activities related to the eco-design characteristics and design management process.

In general the subject found the EMCS *model* to be a combined approach to the use of EMS and eco-labelling - in terms of LCA considerations and assessment methodology. He found the model to have potential for practical application and he believed that the EMCS model can be used by environmental managers, environmental auditors and design managers. He expressed his agreement in the use of an accompanied document that explains in detail the directions to be followed in support of the model. It also discussed the option of using *'eco-points'* in relation to the assessment matrix for environmental awarding of packaging products. The subject felt that the use of an assessment matrix that examined environmental factors related with the design process; manufacturing process; social, legal and performance issues is an applicable extension of the EMCS model. He indicated that in such case a checklist with questions that specified the design of packaging should be supplied. During the free discussion the subject felt that there are guidelines available for EMS and general guidelines for packaging and environment. But these guidelines are suffering because there are scientific data and not easily understood by designers. Also the EMS provided a good number of information for business environmental activities but is not so closely related to the product such as packaging.

A2. The subject found the EMCS *model* to be the most advantageous prototype format compared with the other prototype formats of models. He found the directions and links on the EMCS model to be efficient and the information of good quality. He felt that the EMCS has potential to work in practice and the use of terminology from ISO 14001 will improve its applicability to be used in practice. The subject was also positive in the use of sub-models in support of the main model. He commented about the sub-models of internal and external communication that the stages to be follow are described well but the information in each box needed rephrasing aiming to be more direct. In particular he suggested for the sub-model of external communication to keep only the information presented in the first two lines. He also felt that the presented information should be reduced to the minimum required and an accompanied document could explains in detail the use of the model. Finally he felt that the model can be used by environmental and design managers.

A3. The subject felt that the models were a good interpretation of indicating environmental analysis stages to be followed. In particular he found the EMCS *model* to be the best interpretation compared with the other prototype formats of models. He believed that the EMCS *model* provides clear directions, also the information included is useful and, the structure of the model, the links and the directions are of good construction. He felt that because of that reasons the EMCS has potential to be used in practice. The subject was supportive in the use of sub-models in support of the main model. He mentioned that more attention might required in the use of terminology, directions and the presented information in order to improve the qualities of the model. He suggested to subtract the directions for 'resource requirements' and 'allocated personnel responsibilities' as information about these activities is described in the sub-models of internal and external communication. And, that the auditing cycle it should be kept the indication that is a repetitive cycle. Subject felt that the stages to be followed should be in more descriptive form. In addition, the information about eco-design activities and requirements presented in MEPA model can be kept and the model should be reconstructed and presented in a similar form like the EMCS model. He was also supportive in the use of an accompanied document to be used as a reference in explaining the use of the model. The model was recommended for use by environmental managers, environmental auditors and design managers.

He commented that the EMCS *model* is an extremely good approach to develop assessment methodology for packaging products which combines aspects from the use of EMS and eco-labelling. The option of using *'eco-points'* for environmental awarding of packaging products was discussed with the subject. He felt that the use of an assessment matrix that examined environmental factors related with the design process; manufacturing process; social, legal and performance issues is an applicable extension of the EMCS model. Subject also felt that the use of a checklist with questions that specified the design of packaging should be useful material in guiding the process. During the free discussion the subject felt that there are guidelines available for EMS and general guidelines for packaging and environment. But he found that these guidelines are suffering. Because, for example, environmental legislation - in particular the EC packaging and packaging waste Directive- states requirements and targets to be achieved for packaging without any specification given how these could be achieved in the design stage of packaging;

A4. The subject found that the EMCS *model* provides clear directions, the information included is useful and, the structure of the model, the links and the directions are of good interpretation. He was also expressed his agreement in the use of sub-models in support of the main model. Moreover, subject found that a lot of information was presented and he suggested that the information should be reduced to the minimum required for the model to describe efficiently the stages of environmental analysis that are recommended. About the use of the terminology subject stated that he understood the terms used, but he felt that is more appropriate the use of terminology from ISO 1400. Specifically, he recommended to replace the wording '*strategic* management' with '*environmental management system*' as the central component of the model and replace the wording 'audit' with 'environmental audit'. He also said that the sub-models should describe: the environmental auditing methodology; environmental responsibilities at internal and external level of business operation; and design activities related to the eco-design characteristics and design management process. He found the EMCS *model* to be a good approach in the use of EMS and eco-labelling - in terms of LCA and assessment methodology considerations. The model was recommended for use by environmental managers, environmental auditors and design managers. In addition, subject felt that the EMCS *model* can also be used by an accreditation body. And he indicated that on such occasions the use of the model can be extended to awarding credits for different levels of environmental concern.

The possibilities for environmental awarding on packaging products to those companies that used the model are also discussed with the subject. He expressed his agreement in the use of a rating system as extension in the use of the model. The subject felt that there are guidelines available for EMS and general guidelines for packaging and environment. But he felt that even if EMS provided a good number of information for business environmental activities is not so closely related to the product - such as packaging - itself; Subject also felt that the process of environmental analysis for paper packaging products has certain limitations. For example to access resources and the distance between mining and processing - differ from one paper mill to another as well as from one country to another; It also discussed that the description and the delineation of the system boundary considered can be different. And that the energy content of waste can be taken into account as a negative energy content.

A5. The subject believed that the presented material is of extremely good quality. In particular, he found that the EMCS *model* was the prototype format with the most potential for practical application. According to subject comments the EMCS provides clear directions, and the information included is useful for the purpose of environmental assessment. Also, the structure of the model, the links and the directions are of good interpretation. Subject felt that it is essential the presented information to reduced to minimum required for the model to operate efficiently, he also suggest the use of existing terminology borrowed from EMSs and the use of an accompanied document that describes the process and provides detail instructions in the use of the model. In relation to the sub-models subject felt that they should describe: the environmental auditing methodology; environmental responsibilities at internal and external level of business operation; and design activities related to the eco-design characteristics and design management process. In particular, the information about eco-design activities and requirements presented in MEPA model can be kept and the model should be reconstructed and presented in a similar form like the EMCS model. The model was recommended for use by environmental managers, environmental auditors and design managers. Subject felt that the formulation of the EMCS model presents a good interpretation of the relation of environmental management standards that apply at company level with environmental requirements at product - *packaging* - level.

A6. The subject felt that the presented models are of exceptional good quality and that the format of the EMCS has potential for practical application. The reason stated was the direct links and the format of the presented information. Subject was also positive in the use of sub-models in support of the main model. He suggested that more attention required in the use of presented information and in the use of terminology. In particular he suggested the use of the wording 'environmental audit' instead of the wording 'audit'. He also believed that the sub-models should describe: the environmental auditing methodology; environmental responsibilities at internal and external level of business operation; and design activities related to the eco-design characteristics and design management process. Subject felt that the EMCS is a good structural model to combine the interrelation of environmental management standards that apply at company level with environmental requirements and eco-design specifications at product (paper packaging) level. Subject recommended that the model should be used by environmental managers, environmental auditors and design managers. In addition, subject suggested that the EMCS *model* has also potential to be used by an accreditation body. Subject was supportive in the possibility for

environmental awarding on packaging products to those companies that used the model. The option of using *'eco-points'* and an assessment matrix as an extension in the use of the model for environmental awarding of packaging products was discussed with the subject. He felt that the use of three case studies to demonstrate the potential use of the matrix required. During the free discussion the subject felt that there are guidelines available for EMS and general guidelines for packaging and environment. But he felt that these guidelines are problematic. He stated as an example that environmental legislation (e.g. the EC packaging and packaging waste Directive) states requirements and targets to be achieved for packaging without any specification given how these could be achieved in the design stage of packaging; Finally he recommended that to implement EMAS or Environmental Management Standards in packaging business it is essential to use environmental auditing procedures that examining and address the environmental impact of the whole company's operation.

A7. The subject found that the models are of a good graphical representation of the stages of environmental analysis and indicated his preference in the format of the EMCS model prototype compare with the other five formats of the models. He found that the EMCS *model* contains valuable information material, and that the links and the directions are of good interpretation. He believed that the amount of information included in the model can be reduced and he also stated that the use of terminology requires further examination. He suggested that the wording '*strategic* management' should be replaced with the wording '*environmental management system*' and the word 'audit' should be replaced with 'environmental audit'. About the sub-models of internal and external communication he felt that the stages to be follow are described well but the information in each box needed rephrasing aiming to be more direct. In particular he recommended for the sub-model of external communication to keep only the information presented in the first two lines. In discussion about the number of sub-models, subject felt that the subsidiary models should describe: the environmental auditing methodology; environmental responsibilities at internal and external level of business operation; and design activities related to the eco-design characteristics and design management process. He found applicable the model to be used by environmental managers, environmental auditors and design managers. He also suggests that the EMCS *1* can also be used by an accreditation body. He felt that it is worth considering the concept of extending the use of the model in awarding credits for different levels of environmental concern.

A8. The subject felt that the work is of good quality and, indicated his preference in the format of the EMCS *model* for a practical use. The reason was that the format that the information presented on the EMCS is precise, the directions are clear, and the structure of the model is communicative. However he suggested to reduce the amount of presented information and he expressed his agreement in the use of an accompanied document that describes precisely the stages indicated in the model. In addition he recommended that attention required in the use of the terminology and where possible should be borrowed from EMSs. The subject recommended the use of the wording 'environmental audit' instead of the wording 'audit' and that the auditing cycle it should be kept the indication that is a repetitive cycle. Also, he felt that the stages to be followed should appear in more descriptive form. In relation to the sub-models the subject was supportive in the use of subsidiary models as part of the main model. He also felt that is appropriate to include the following five sub-models about: the environmental auditing methodology; environmental responsibilities at internal and external level of business operation; and design activities related to the eco-design characteristics and design management process. He believed that the model can be used by environmental and design managers.

Subject felt that the use of an assessment matrix that examined environmental factors related with the design process; manufacturing process; social, legal and performance issues is an applicable extension of the EMCS model. Subject also indicated his preference in the use of a checklist with questions that specified the design of packaging in support of the matrix applied to design factors. The option of using *'eco-points'* for environmental awarding of packaging products was considered positively as an extension in rating the environmental activities indicated by the model.

A9. The subject found that the EMCS model to be the prototype format with the most potential for practical use. He found appropriate the use of terminology and the links and he agreed in the use of the presented information. However, he suggested that more considerations should directed in revising the use of the terms to be more precise and more close with the ISO 14001. In particular, he suggested the use of the wording '*environmental management system*' instead of '*strategic* management' and the wording 'environmental audit' in replacement of the word 'audit'. He felt that the information about eco-design presented in MEPA model can be kept but he recommended that the model should be reconstructed and

presented following the structure of the EMCS model. The subject expressed his agreement in the use of sub-models in support of the main model. He felt that the EMCS can be used by environmental and design managers. In addition he also felt that the *model* can be used by an accreditation body.

During the free discussion it brought up that the EMCS is an interesting conceptual model that formulated environmental management standards that apply at company level in relation with environmental requirements and eco-design specifications at product (packaging) level. The option of using *'eco-points'* for environmental awarding of packaging products commented as a useful extension in rating the environmental performance of businesses that use the model. Subject felt that the use of an assessment matrix that examined environmental factors related with the design process; manufacturing process; social, legal and performance issues is an applicable extension of the EMCS model. Finally the subject felt positively in the use of a checklist with questions that specified the design of packaging in relation to the matrix.

A10. The subject found the material of good quality and the EMCS a very good interpretation closely related with the scope of the EMS standards. He also found the directions on the EMCS to be clear and precise, the information useful and, the structure of the model, the links and the directions of good quality. The subject positively accepted the use of sub-models in support of the main model. And he agreed in the use of the five following sub-models in relation to: environmental auditing methodology; environmental responsibilities at internal and external level of business operation; design activities related to the eco-design characteristics and design management process. The model was recommended for use by environmental managers, environmental auditors and design managers. The option of using *'eco-points'* for environmental awarding of packaging products was considered acceptable by the subject. He also felt that the use of an assessment matrix that examined environmental factors related with the design process; manufacturing process; social, legal and performance issues is an applicable extension of the EMCS model. Subjects also felt that in such case a checklist with questions that specified the design of packaging is required. During the free discussion the subject felt that there are guidelines available for EMS and general guidelines for packaging and environment. He indicated the drawbacks of such guidelines in terms of that scientific data are not always understood by designers; and that environmental legislation (such as the EU packaging and packaging waste Directive) states requirements and targets to be achieved for packaging without any specification given how these, could be achieved in the design stage of packaging.

A11. The subject expressed his interest in the structure of the models he indicated that he has never come across with something similar and he found that the EMCS *model* provides transparent directions, also the information included is useful and, the structure of the model, the links and the directions are of good format. The subject found the use of sub-models as a logical part in support of the main model. He recommended that in the auditing sub-model the auditing cycle should carry the indication that is a repetitive cycle, and he suggested that the auditing stages should provide more detail information. In relation to the sub-models of internal and external communication he found the stages to be follow to be described adequately well but he suggested that the information in each box to be rephrasing aiming to be more direct and communicative. In particular he suggested for the sub-model of external communication to keep only the information presented in the first two lines. He agreed in the use of five subsidiary models about: environmental auditing methodology; environmental responsibilities at internal and external level of business operation; design activities related to the eco-design characteristics and design management process. He found that the information about eco-design activities and requirements presented in MEPA model appropriate to be used as a part EMCS model. The model was recommended for use by environmental managers, environmental auditors and design managers. In addition, he felt that the model can also be used by an accreditation body. Finally he found the formulation of the EMCS to interrelate environmental management standards that apply at company level with environmental requirements with eco-design specifications at product (paper packaging) level. During the free discussion it has been recommended that to implement EMAS or Environmental Management Standards in packaging business it is essential to use environmental auditing procedures that examining and addressing the environmental impact of the whole company's operation. It also stated in relation with the limitations of environmental analysis for paper packaging products that the use of LCA depends upon the size of delivered product.

B1. and B2. Subjects felt that the material presented on the models are of very good quality. Besides they found the EMCS *model* to be the best interpretation compared with the other prototype formats of models and with the most potentials to work in practice. In particular, they found that the EMCS *model* provides clear step-by-step directions, and the information included is useful and, the

structure of the model, the links and the directions are of good interpretation. Subjects were also positive in the use of sub-models in support of the main model. Subjects suggested that the terminology should be borrowed from the ISO 14000. In particular, subject B2. indicated that attention should be given not to inventing new terms because of being pressure by ISO - *and is an international institute.* He emphasised that it might well be that what the research project is doing, fit very nicely with what ISO is doing where, if the research use new terms people may will not see that. It also mentioned that is appropriate to borrow terminology from ISO 14000 because is the most recent standards on EMS and because the ISO series are more closely related to the product as they develop LCA methodology and guidelines for eco-labelling.

He also indicated that what the diagrams (*models)* are describing is very similar with ISO but formatted differently. In relation to this point subjects stated that they had never come across with such formats of models of environmental analysis and that they found them useful and valuable interpretation of environmental management principles related with and with effects to product design such as packaging. It has been suggested that the EMCS model required to be more flexible and more presentable for standard material, and that as a result will make it more easy to be adopt.

Subjects also suggested that efforts should be made to reduce the amount of information presented to the minimum required for the model to describe efficiently the stages of environmental analysis that are recommended. Furthermore, they suggested the use of an accompanying document that explains in detail the directions to be followed in support of the structure of the model. Subject B2. also commented that he found LCA and auditing methodologies to be very similar and the procedures set by the research at the idea are all very new in that short of area. And what subject believed, it should be done is developing a number of documents whether they are looking in different levels and saying if you want to do this way or if you want to do it with different standards and, it seems to him, that in very much longer line this idea has potential. Subjects were also supportive in the use of sub-models. The model was recommended for use by environmental managers, environmental auditors and design managers. In addition, subjects felt that the EMCS *model* can also be used by an accreditation body. On such occasions the use of the model can be extended to awarding credits for different levels of environmental concern. The possibilities for environmental awarding on packaging products to those companies that used the model, the option of using *'eco-points'* and the use of an assessment matrix as extension in the use of the model was also discussed. They felt that the use of an assessment matrix that examined environmental factors related with the design process; manufacturing process; social, legal and performance issues is an applicable extension of the EMCS model. Subjects suggested the use of three case studies to demonstrate and validate the potential use of the matrix. Finally, subjects felt in relation to the matrix, that a methodology for developing guidelines - *to help develop criteria for packaging* - required a list of questions that should be answered in order to develop such criteria.

B3. The subject found the presented material of very good quality. In particular he found the EMCS *model* to be the best interpretation compared with the other prototype formats of models and with the most potential for practical application. In particular, subject found that the EMCS to be a good structural *model* and expressed his agreement in the use of the directions and information provided. Subjects also found useful the use of the sub-models in support of the main model. Moreover, he suggested that the terminology should be borrowed from the ISO 14001 as the models follow the same environmental management principles but format very differently. Moreover, subject said that he had never come across with such interpretations of models of environmental analysis and he believed to be very useful material for packaging industry. In addition he commented that definitions should be borrowed from ISO for the development of the EMCS, mainly because ISO are the most recent standards on EMS and are international in spec. He suggested the use of the wording 'environmental audit' instead of the wording 'audit' and, he also suggested to subtract the directions for 'resource requirements' and 'allocated personnel responsibilities' as information about these activities is described in the sub-models of internal and external communication. He felt that the sub-models should describe: the environmental auditing methodology; environmental responsibilities at internal and external level of business operation; and design activities related to the eco-design characteristics and design management process. The model was recommended for use by environmental managers, environmental auditors and design managers. In addition, subject felt that the EMCS *model* has potential to be used by an accreditation body.

The option of using *'eco-points'* and an assessment matrix for environmental awarding of packaging products in extension in the use of the model was discussed with the subject. He felt that the use of an assessment matrix that examined environmental factors related with the design process; manufacturing process; social, legal and performance issues is an applicable extension of the EMCS model and will be a useful way to provide specifications for packaging businesses. The limitations of environmental analysis for paper packaging products was also discussed. Subject said that one limitation of environmental analysis is the ways in which electricity and/or forms of mechanical energy are produced.

Electricity from water power is likely to be different from an environmental point of view than electricity from heat either produced by combustion of fuels or from nuclear fission reactions. He also found another limitation to be the technology of processing. The extraction of sulphur, for example, from fuels or the treatment of combustion gases to absorb sulphur dioxide enhances other waste-streams and energy uses. Finally, he believed that the EMCS *model* is a good formulation that interrelate environmental management standards that apply at company level with environmental requirements and eco-design specifications for packaging.

B4. The subject found the models of very good quality and the EMCS format as more applicable for practical application. She found that the EMCS format is closely related with the scope of EMS and that the *model* is constructed in a clear and direct format. In addition she found the presented information useful and handy the use of sub-models in support of the main model. She suggested about auditing cycle that it should be kept the indication that is a repetitive cycle, and for the stages to be followed should provide more detail information. Subject also found the EMCS *model* to be a good combined approach to the use of EMS and eco-labelling, because of the use of LCA considerations and assessment methodology. The model was recommended for use by environmental managers, environmental auditors and design managers. In addition, subject felt that it should be considered the use of the model by an accreditation body. It suggested that the EMCS *model* should use the terminology provided by ISO series on EMS because of its international authority and because the ISO series are more closely related to the product as they develop LCA methodology and guidelines for eco-labelling.

MODELS TESTING *1st Phase.* Interviews analysis - Demographics of the Subjects

Candidate	Occupation	Geographical area	Business activity
A1.	Head of Production	Leicester	Packaging retailer manufacturer
A2.	Managing Director	Northampton	Packaging retailer manufacturer
A3.	Packaging Specifier	East Midlands	Packaging retailer manufacturer
A4	Environmental Advisor	Nottingham	Packaging retailer manufacturer
A5.	Manager	East Midlands	Environmental consultancy
A6.	Environmental Advisor	Leicester	Environmental consultancy
A7.	Environmental Advisor	Nottingham	Environmental Consultancy
A8.	Manager	London	Design Consultancy
A9.	Head of Design	Leicester	Design Consultancy
A10.	Chief Designer	Leicester	Design Consultancy
A11.	Production Manager	Leicester	Design Consultancy
KEY INFORMATS			
B1.	Finance and Operations Manager	London	UKEB - UK Ecolabelling Board
B2.	Principal Scientist		*EU* Ecolabelling
B3.	Technical Advisor	London	Packaging Organisation
B4.	Manager	Leicester	European Information Centre

	Occupation	Geographical area	Business activity
	Head of Production/ Manager/ Director = 8 **Packaging Specifier/ Scientist = 3** **Packaging Design = 2** **Environmental Advisor = 4**	**UK based sites.**	**Packaging retailer Manufacturer = 4** **Environmental Consultancy = 3** **Design Consultancy = 4** **Governmental bodies = 4**

Table VI.3. Instrument used in the EMCS *model* Evaluation - *2nd Phase*
FINAL FORMAT

The final format of the EMCS *model* that includes the sub-models assessed in one-to-one evaluation. The interviewers were contacted as follow up from previous stage of the research activities those people that indicated that they were willing to co-operate again in a later stage of the research progress. Those interviewers classified as **C.** respondents before the numerical value corresponding to the number of subject.

For this purpose 40 companies conducted and 22 respondent to be interviewed. The one-to-one evaluation at this stage made by phone but the evaluation materials (models and questionnaire) send to the potential interviewer prior to the interview. In addition of the evaluation of EMCS model the aspect of assessment matrix also discussed.

This evaluation took place from September 1998 to mid-December 1998. The interview schedule were as follows.

SECTION 1. **Model Testing - *Introduction***
Initial it was explained to the potential interviewer by phone that the Ph.D. research was close to completion and that it required at that stage a final evaluation of the EMCS *model* which mend to be the final outcome of the study. Prior to the interview copies of the EMCS *model* with the documentation that explained the operation of the model had send by post to the participants accompanied with the evaluation questionnaire. The materials were also included a covering letter that summarised the aims of the project and the interview and remind to the participant the day and time that the interview was going to take place. It also, acknowledged the participants willingness to co-operate with the research, promised them that confidentiality will kept at any time and that the information provided will be used for academic purposes.

SECTION 2. **Personal Details - *Confidential***
This section had completed in advanced by the researcher as the information applied were already known from previous contacts.

SECTION 3. **EMCS *model.* Final Format Model Evaluation - *Attitude Questionnaire***
The *model* I have sent you aims to be used by paper and packaging companies on the way to address and evaluate their environmental activities and performance. At present, the *model* is due to completion and any considerations for improvements will considered extremely valuable. The *questionnaire* I am sending you prior to the interview consists of nine items, provided below. Please feel free to make any additional comments and indicate any disagreement or misunderstanding in the format of the model.

1) Do you believe that the use of terminology is appropriate?
   1a) Does the terminology describe adequately the stages indicated?

2) Are the EMCS model and the sub-models self explanatory from one stage to another?
   2a) Do you understand the directions and the links provided?
   2b) Please state if something is missing or not described adequately.

3) Do you think there is enough information and direction provided? - Please feel free to make any recommendations.

4) Do you find the model effective for use by packaging companies?

5) If the packaging companies used the EMCS model how often do you believe they should repeat their activities? ❑ Once a year ❑ Once every two years ❑ Once every three years ❑ Once every four years ❑ Once every five years ❑ Other (please state)

6) Do you think that the assessment matrix works well in conjunction with the EMCS model?

7) Do you believe that the EMCS model and the matrix provide useful guidelines for packaging companies to manage and assess their environmental performance.

8) Who do you believe could use the model?
   a) Environmental manager *within the company* ❑ Always ❑ Most of the time ❑ Hardly ever ❑ Never
   b) Environmental Consultancy *external* ❑ Always ❑ Most of the time ❑ Hardly ever ❑ Never
   c) Environmental auditor (internal or external) ❑ Always ❑ Most of the time ❑ Hardly ever ❑ Never

d) Head of Design/ Design Manager ❑ Always ❑ Most of the time ❑ Hardly ever ❑ Never
e) Design Consultancy ❑ Always ❑ Most of the time ❑ Hardly ever ❑ Never
f) Other. (Please specify) ..... ❑ Always ❑ Most of the time ❑ Hardly ever ❑ Never

9) Do you have any suggestion for inclusion on the final model?
Additional Comments .....

Thank you for your valuable help and co-operation.

Table VI.4.: Content analysis of data collected from one-to-one evaluation *Attitudes Questionnaire - EMCS model.* - 2nd Phase *FINAL FORMAT*

COMMUNICATION - USER UNDERASTANDING

Clear and precise step by step directions on how to proceed in achieving environmental performance initiatives.
The use of the terminology is very effective and easy to understood.
Very useful the accompanied document that explained the use of the model, the methodological steps and terminology.

PERFORMANCE - EFFECTIVNESS IN USE/ PRACTICALITY

The EMCS model is an extremely good interpretation of environmental management principles applicable for packaging design.
The main model illustrated in an effective and structural way the stages of environmental analysis to be followed. The subsidiary models work well and explain the points in support of the main model
The EMCS has a practical application and, its flexible format make it easy to be adopt by company of any size and from those that do not have an environmental management system in place.
The model can be used by environmental managers, environmental auditors and design managers. In addition by an independent environmental auditor/ consultancy and design /consultancy and by an accreditation/ certification body on environmental management system.
The use of the assessment matrix is very effective as an extension in the use of the EMCS model.

SUMMARY OF RECOMMENDATIONS

Very good recommended solution for applying environmental management principles on packaging businesses.
Very good interpretation of environmental analysis closely related to ISO 14000 requirements and environmental management systems that are in place.
The period of registration suggested to be every three years. In addition there should be annual reviews to check that the operation runs efficiently.

SUGGESTIONS FOR FURTHER IMPROVEMENTS

The assessment matrix required further development in relation, for example, to specify the use and appearance of the eco-points on packaging products.

C1. The subject found that the EMCS model is an extremely good interpretation of environmental management principles applicable for packaging design. Subject felt that the use of the terminology is appropriate and the directions are clear and precise. Subject expressed his satisfaction about the use of sub-models in support of the main model. Recommendations for changes apply to the use of the sub-model describing the auditing activities. He suggested to replace the wording between establishing the audit and running the audit from 'the scope' to 'define the scope' for a better description of the process. He felt that the EMCS illustrated in an effective and structural way the stages of environmental analysis to be followed. Subject found useful and informative the accompanied document that explained the use of the model, the methodological steps and terminology.

Subject found the model to have a practical application and potentials to be used by environmental managers, environmental auditors and design managers. In addition he felt that the model can also be used by an independent environmental auditor/ consultancy and design /consultancy. He felt that the model has flexibility to adopted by packaging company of any size. For the period of registration suggested to be every three years. However, he felt that there should be annual reviews to check that the operation runs efficiently. The concept of the assessment matrix was also evaluated with subject that was very supportive of the use of the matrix as extension of the EMCS model. He felt that the matrix provided valuable specifications for paper packaging as a part of the EMCS *model* to formulate decisions for packaging design. He also found the use of the Eco-points appropriate for paper and board packaging.

C2. The subject stated that he was impressed with the formulation of the EMCS model. He felt that the model provide clear and precise step-by-step direction on how to proceed in achieving environmental performance initiatives. He found the use of terminology easy to understood and precise and, the sub-models to explain in a structural way the points illustrated in the main model. His recommendations dealing with the sub-model of operation method at external communication. Specifically, he recommended the wordings describing the activities to be followed in each stage should be used in a reverse order. The first stage should be described as 'identification approach' with the explanation '*market needs*' and, not 'market needs' with the explanation '*identification approach*' as it was. In addition, the wording at the stage seven suggested to change from 'feedback - *informative approach*' to 'informative approach - *feedback, disseminate results*'. In relation, to the -model of operation method at internal communication, he recommended the wording at the stage four to change from 'evaluate options' to 'evaluate options for improvements' also, the wording at the stage seven to change from 'feedback - *devising*' to 'communicative the results - *feedback, devising the findings*' and, wording at the stage eight to change from 'future improvements - *generating*' to 'investing in future improvements - *generating new enquiries*'. He found that the model has a practical application as a good instructional references for those conducting and evaluating environmental impact assessment for paper packaging products. He believed that the model should be used by environmental managers, environmental auditors and design managers. He also believed that the model can be used by an accreditation/ certification body on environmental management system. For the period of registration suggested to be every three years or every four years.

The subject found the concept of using the matrix as extension of the EMCS model, and the use of eco-points to indicate the different levels of environmental commitments and concerns very useful material for the formulation of environmental activities in packaging business sector. He found that the assessment matrix has potential to be used by an accreditation body but, in such case further work is required to specify the use and appearance of the eco-points on packaging products.

C3. The subject found the EMCS to be a useful model that relates the corporate environmental philosophy with the design activities. He felt that is a desirable solution for managing environmental management principles compatible with the packaging design process. Subject found clear and precise the direction provided and the use of terminology easy to understood and follow. He felt that the sub-models explain in a structural form the points indicated in the main model. He found very useful the accompanied document that explained the use of the model, the methodological steps and terminology. In relation to recommendations for improvements he suggested that in the sub-model describing the auditing activities the wording between establishing the audit and running the audit should be change from 'the scope' to 'define the scope' for a better description of the process. Subject found the model to have practical application for packaging companies in order to control and further reduce the environmental impact of their operation. He believed that the model has potentials to be used by environmental managers, environmental auditors, design managers. and by an independent environmental auditor/ consultancy and design /consultancy. For the period of registration he suggested to be every three years. In relation to the assessment matrix subject found that is an appropriate extension in the use of the model. The interesting he found about the Assessment Matrix for paper based packaging, is that it examines the product life-cycle stages against four factors that determine product environmental impact.

C4. The subject found that the EMCS model is an extremely good framework of environmental management principles applicable for packaging design. She found the directions precise and easy to follow and the use of the terminology very applicable and closely related to environmental management standards. Subject found the use of the sub-models well established to explain in detail the process to be followed. And, she felt that the accompanied document is very useful. Moreover, she suggested in the sub-model of operation method at external communication, to change the wordings describing the activities

to be followed in each stage in a reverse order. She suggested that the first stage should be described as 'identification approach' with the explanation '*market needs*' and, not 'market needs' with the explanation '*identification approach*' as it was. Finally she found the EMCS to be a good structural model with applicability for packaging businesses. She felt that the model can be used by company of any size but, she indicated that most probably, is more applicable to big enterprises as they have more resources available. She said that the model can be used by environmental managers, environmental auditors and design managers. Also, by an accreditation/ certification body on environmental management system. She suggested that the period of registration should be every three years.

Subject found useful the matrix as extension of the use of the model in a rating system. In particular, he found that the different stages described by the matrix are easy to understood by designers and design managers as well as by people responsible for packaging production such as technical staff in the manufacturing process, marketing department and accounting. He felt that the use of the Assessment Matrix provide appropriate indication to measured against the environmental performance of paper packaging products in different stages of products' LCA. Finally he recommended the use of the assessment matrix in the reverse order, in order to provide indication for areas of environmental concern.

C5. The subject found that the EMCS presents useful material and illustrates well the process of environmental analysis. He found that the model has a practical application for packaging businesses. He felt that the sub-models are very appropriate in support of the main model and that each sub-model can works independently in order to examine particular areas of companys' operation. He stated that the directions and the terminology indicated well the stages to be followed. He also found very useful the accompanied document that explained the use of the model, the methodological steps and terminology. He believed that the auditing cycle is very well described. He suggested that the model can be used by environmental managers, environmental auditors and design managers. For the period of registration suggested to be every three years however, there should be annual reviews to check that the operation runs efficiently. Finally, the subject was supportive in the Assessment Matrix designed to be used in conjunction with the EMCS *model.* He stated that if a paper packaging company use the EMCS *model* to manage and control its environmental activities the use of the *Assessment Matrix* measures these activities. Subject found that the matrix can be used by an accreditation body. In such case he indicated that further work is required to specify the use and appearance of the eco-points on packaging products. He also felt that if an accreditation body use the matrix further work might required to specify the involvement and the role of an independent verifier and to identify the appropriate period of registration.

C6. The subject found that the EMCS model is an extremely good interpretation of environmental management principles applicable for packaging design. Subject felt that the model is well structured with clear direction, good use of the terminology and that the subsidiary models are well formatted in support of the main model. He recommended about the sub-model of operation method at internal communication, to change the wording at the stage four, from 'evaluate options' to 'evaluate options for improvements' also, the wording at the stage seven to change from 'feedback - *devising*' to 'communicative the results - *feedback, devising the findings*'. Subject found that the EMCS illustrated in an effective and structural way the stages of environmental analysis to be followed. He also found that the EMCS is compatible with EMSs and in particular with ISO 14001. Subject found that the model has a practical application. For the period of registration suggested to be every three years. He believed that the model should be used by environmental managers, environmental auditors, independent environmental auditor/ consultancy and design /consultancy as a problem solving techniques. Finally, subject found the model applicable to company of any size.

The subject found appropriate the use of the suggested matrix for paper packaging products to measure the activities of a company that use the EMCS to manage and control such environmental activities. He identified another use of the assessment matrix in the reverse order, in examining individual areas of environmental concern. Subject felt that if the matrix is going to be used by an accreditation body further work is required to specify the use and appearance of the eco-points on packaging products.

C7. The subject found that the EMCS provides clear, step-by-step guidance on environmental analysis. She also found the use of the terminology appropriate to explain the point. And, the sub-models well established in support of the main model. In particular she found the auditing sub-model very useful and the auditing cycle very well described. In relation to this sub-model she recommended to change the wording between establishing the audit and running the audit from 'the scope' to 'define the scope' for a

better description of the process. In addition she found useful the accompanied document that explained the use of the model, the methodological steps and terminology. Subject felt that because of the clear and direct structure of the model and the effective use of the terminology the model has a practical application. In particular she felt that the model can be used by an independent environmental auditor/ consultancy, design /consultancy, by environmental managers, environmental auditors and design managers and, by company of any size. She also found the model to have potential to used by an accreditation/ certification body on environmental management system. She felt that the period of registration could be between two to three years. In addition she suggested that each sub-model can be used independently to provide annual reviews in particular aspects of the operation.

Subject felt that the Assessment Matrix can be beneficial used in conjunction with the EMCS *model.* She found that the use of the *Assessment Matrix* measures and rates the environmental activities operated accordingly with the EMCS model. She felt that the format of the matrix is easy to understood by designers and design managers as well as, by technical staff, marketing department and accounting. She believed that in some instances might be useful each factor to examined independently in providing specifications for the company to take action regarding its operation, packaging products or activities. She found the checklist for packaging design which accompanied the design factors of the matrix to be extremely useful in formulating decisions for packaging design and also for checking and controlling the packaging design process. However, she felt that the question in the checklist required to be rephrased in order to be more direct. Finally, she suggested that additional design considerations could be in relation of examining the suitability and the overall cost of the packaging aiming to meet all the product requirements at the minimum overall cost.

C8. The subject found the model to provide step-by-step directions on how to proceed in formulating environment systems on packaging businesses. Specifically the subject found the EMCS to be a good instructional reference to those conducting environmental analysis, very much compatible with environmental management standards. Subject felt that the use of terminology is easy to understood and that the accompanied document explain very well the process. The subject was very supportive in the use of the subsidiary models in particular, he felt that they were very well structured and the indications provided are very much appropriate for the process of environmental analysis. Subject found the EMCS to have a practical application by companies of any size and, as user he indicated design managers and environmental managers. In addition he suggested independent environmental auditors/consultancies and design consultancies. Subject recommended for the period of registration to be every three years.

The subject felt that the matrix is a useful extension of the EMCS and has potential to be used by an accreditation body. He commented that in such case additional work is required to specify the use and appearance of the eco-points on packaging products and, more considerations should directed about the role of an independent verifier. Subject felt that the checklist for packaging design provide extremely useful indications. He believed that additional considerations might be to examine options of minimising the overall cost of the packaging without comprising on products environmental requirements. He also said that specific considerations should addressed the efficient use of energy requirements during production, transportation and distribution.

C9. The subject felt that the EMCS is an excellent generic model that interpreted precisely the theory of environmental management systems for packaging businesses. Moreover, subject felt that the model provided clear and precise step-by-step direction on how to proceed in achieving environmental performance initiatives. He felt that the use of terminology is easy to understood and well explained in the accompanied document. Subject found the sub-models of good quality and with useful indications of the stages to be followed. In particular he felt that the auditing cycle is very well described and, that the sub-model in relation to packaging provides very good guidelines for the design process. Subject found the model to have a practical use by company of any size and from those that do not have an environmental management system in place. Because of the flexible format of the model and, because it includes all the relevant considerations of the process of environmental analysis, he suggested that the model should be used by environmental managers, environmental auditors and design managers. And, he found that the model has potential to be used by an accreditation/ certification body on environmental management system. He suggested for the period of registration suggested to be every three years.

The subject found very valuable the extension in the use of the model through the matrix. He commented that he was impressed with the formulation of the matrix and he said that is very communicative for designers and design managers and by people responsible for packaging production

such as technical staff in the manufacturing process, marketing department and accounting. He recommended that the matrix related with the design factors can be completed by the environmental manager or by the Design Manager of the company in collaboration with the environmental manager. He felt that the Eco-points should be awarded by an external environmental auditor after a site inspection.

C10. The subject found the EMCS to provide efficiently and precisely step-by-step directions on environmental management systems for packaging businesses. Subject felt that the directions and the instructions are well formatted. The use of terminology is easy to understood and the sub-models work well to explain the points in support of the main model. He also found the description of the operation of the model on the accompanied document of good quality. Subject found the model to have a practical application and potential to be used by environmental managers, environmental auditors and design managers. He recommended that the process should be repeated every three or two years by those companies that used the model. Finally, he found that the EMCS is compatible with the theory and applicable of environmental management systems. In addition he felt that the model indicates in a pioneer way the relation of the packaging products with the company's environmental activities and management system, and that led the way to create standardised procedures for the environmental performance of paper packaging products.

Subject found that the Assessment Matrix for paper packaging products gives specifications for paper packaging in extension in the use of the EMCS model to formulate decisions for packaging design. He felt that the matrix offers real benefits for paper packaging businesses in terms of giving indication to measured against the environmental performance of paper packaging products in different stages of products' LCA. He also found appropriate the checklist for packaging design. And, he suggested that additional considerations should involved to estimate the production cost aiming to be the minimum that satisfies products' requirements. Also considerations can deal with the efficient use of energy requirements.

C11. The subject found the use of the EMCS practical for packaging businesses in order to achieve environmental management standards. In particular he mentioned the usefulness of the model in relation to the establishment of environmental management systems for packaging companies. Subject felt that the structure of the model is clear and informative and the use of terminology easy to understood. He felt that the sub-models are good material with appropriate instructions to be followed. He was pleased with the information provided in the supplementary document accompanied the model and, he also mentioned that the EMCS model is self explanatory that means that the process indicated can be understood even without reading the document. Subject was satisfied with the auditing model and he felt that auditing cycle is very well described however he suggested some modification in relation to this sub-model. This is to change the wording between establishing the audit and running from 'the scope' to 'define the scope' for a better description of the process. He was very supportive in terms of the practical application of the model by environmental managers, environmental auditors and design managers. He felt that the model supply good instructional material for the managerial level of companys' operation. Finally he found the model to have applicability by company of any size and, the period of registration suggested to be every three years however, there should be reviews annually or every two years to check that the operation runs efficiently.

The concept of the assessment matrix was also evaluated with the subject. He was very supportive of the use of the matrix as extension of the EMCS model. Subject felt that the matrix provided valuable specifications for paper packaging and the use of the Eco-points is good interpretation in measuring the levels of environmental concern. He found that the Assessment Matrix give reliable indication to measured against the environmental performance of paper packaging products in different stages of products' LCA. About the checklist for packaging design commented that is a very useful tool in formulating decisions and providing the foundation to controlling the packaging design process. He felt that the checklist should indicates the effective use of raw materials and processing. He recommended that the matrix should be completed by the environmental manager and, by the Design Manager in collaboration with the environmental manager. He felt that the Eco-points should be awarded by an external environmental auditor and accreditation body.

C12. The subject said that he was impressed with the format of the model. In particular, he said that it provides precise directions on how to proceed in achieving environmental management principles. He felt that the model is of very good structure with clear and precise directions and effective use of the terminology. He found the supplementary document of good quality and the structure of the sub-models to

provide good instructions in order to formulate, examine, monitor and control the whole process. He recommended changes in relation to the sub-model of operation method at external communication, he suggested to change the wordings describing the activities to be followed in each stage in a reverse order. For example, the first stage should be described as 'identification approach' with the explanation '*market needs*' and, not 'market needs' with the explanation *'identification approach'* as it was. In addition, wording at the stage seven suggested to change from 'feedback - *informative approach*' to 'informative approach - *feedback, disseminate results'*. For the sub-model of operation format for packaging design he suggested that 'environmental declaration, eco-labelling' should be replaced by 'eco-points - environmental declaration' as this is the suggested option by the research to be used as an extension in the use of the model, also the word 'accreditation' could be added as this is in general the process described in that box. In addition, in the column that stated the 'eco-design considerations' the environmental needs and market needs should presented together as are closely related and, the document explaining the use of the model should present what these considerations involve. Subject found the model to have a practical application and to used by environmental managers, environmental auditors and design managers. He also felt that the model can be adopted by an accreditation body on environmental management systems. He suggested that the process should be repeated every three years.

Subject found the matrix to work well in conjunction with the model. He felt that the Assessment Matrix provides a good number of considerations about products' LCA, to measured against a number of environmental factors indicated. In addition, subject found useful the checklist provided packaging design considerations. However, he felt that the questions required to be rephrased in order to be more direct. He suggested that the checklist should emphasised environmental considerations in assessing the effective use of raw materials. Subject found the matrix to have potential to be used by an accreditation body. He felt that further work is required to specify the use and appearance of the eco-points on packaging products. and the role of the verifier.

C13. The subject found useful the model also he indicated that the model is of an exceptional good quality and with practical application for packaging businesses. In particular he found good the direction, efficient the structure of the model and sub-models, appropriate the use of the terminology and precise the format of the information provided. He felt that the accompanied document is of good quality. Subject found that the model can be used by environmental managers, environmental auditors and design managers. In addition subjects felt that the model can also be used by an independent environmental auditor/ consultancy and design /consultancy as a problem solving techniques. He felt that the flexibility of the EMCS in terms of the main model and sub-models that can be used independently of the main model, allows the model to be used by company of any size and from those that do not have an environmental management system in place. For the period of registration he suggested to be every three years.

Subject found interesting the use of the assessment matrix on the way that design considerations have been brought up. He found useful the format that the Assessment Matrix examines the product life-cycle stages against four factors. He felt that the matrix is an appropriate extension in the practical use of the model. Subject also felt that the matrix can be easily understood and used by designers and design managers. In particular, he mentioned that the matrix offer benefits that relates the company operation with the packaging product by examining four factors against the different stages of products' LCA. Subject suggested the matrix to be completed by the environmental manager in conjunction with the Design Manager. And, he found that the Eco-points should be awarded by an accreditation body.

C14. The subject felt that the model is described well the stages of environmental analysis to be followed and he also mentioned that the model presents a unique interpretation in the relation of the product - packaging - with environmental management systems. Moreover, subject felt that the model provided clear and precise step-by-step direction that are also well explained in the accompanied document. In addition, that the use of terminology is easy to understood and the sub-models work well and explain the points in support of the main model. However he suggested a modification in relation to the sub-model describing the auditing activities he said that the wording between establishing the audit and running the audit should be change from 'the scope' to 'define the scope' for a better description of the process. Subject found the model to have a practical application and recommended to be used by environmental managers, environmental auditors and design managers. He also felt that the model can be used by an independent environmental auditor/ consultancy and design /consultancy. He suggested for the

period of registration to be every three years however, there should be annual reviews to check that the operation runs efficiently but, that depends on the budget of the company.

Subject found appealing the use of the assessment matrix in considerations regarding design decisions. He said that the ranking in each matrix are communicative information about a company's environmental activities. Moreover, subject found useful the matrix as an extension in the applications of the model. He felt that if the matrix is going to be used by an accreditation body further work is required to specify the use and appearance of the eco-points on packaging products.

C15. The subject felt that the model provides a generic solution in managing environmental performance for packaging businesses. He felt that the links and directions are well indicated and that the use of terminology is appropriate and closely related with EMS. He found the information in the accompanied document very clear and the sub-models very practical. However, he recommended some changes in relation to the sub-model describing the auditing activities. He suggested to change the wording from 'the scope' to 'define the scope' for a better description of the process. He also suggested for the sub-model of operation method at external communication, to change the wordings describing the activities to be followed in each stage in a reverse order. For example, the first stage should be described as 'identification approach' with the explanation '*market needs*'. Subject was positive in the use of the model for a practical application and by packaging company of any size. He felt that the model can be used by environmental managers, environmental auditors and design managers. In addition, subject felt that the model can also be used by an independent environmental auditor/ consultancy and design /consultancy as a problem solving techniques, so the companys' products may be able to meet assessment ecological criteria. He recommended the period of registration suggested to be every three years.

Subject felt that the interpretation of the assessment matrix for paper based packaging allows the company to clearly indicate the level of its environmental commitments He found the matrix an appropriate extension in the use of the model in rating the environmental performance of those companies that used the model to control the process of their operation. He felt that the factors examined in the matrices are simplified and in more comprehensive list could compile several factors (e.g. toxicity of materials). He indicated than in such case there is a danger for the matrices to be complicated and more difficult to used. Subject found that the checklist provide useful design considerations. He also mentioned that additional considerations could apply in assessing the impact of post- consumer waste, and assessing the impact and the use of waste arising at each stage of processing and distribution. He found that the use of the matrix lead the way for an environmental declaration for paper packaging products.

C16. The subject found the EMCS to work in practice as a good instructional model at the managerial level of companys' operation. About the structure of the model subject expressed his agreement in the use of directions and terminology. He also, found well constructed the sub-models and useful the accompanied document. Subject felt that the EMCS is compatible with ISO 14000 and indicates effectively the relation of the packaging product with the company's operation on environmental management systems. For this reason subject found the model to have a practical application and potentials to be used by environmental managers, environmental auditors and design managers. He also believed that the model can be used by an accreditation/ certification body on environmental management system. Subject felt that the model can easily adopted by company of any size in particular he felt that the model it will be more applicable by big enterprises, because big enterprise tend to be more keen in adopting environmental management standards than smaller enterprises. For the period of registration suggested to be every two or three years.

Subject said that the interpretation of the assessment matrix for paper based packaging clearly indicates the level of environmental commitments and is an applicable extension in the use of the model. Subject commented on the formulation of the Assessment Matrix that gives the chance for the company to plan design decisions at the early stage of the product development . He found that the checklist provide a good number of consideration about design decisions. Additional environmental considerations could be related with the use of an identification system about materials to assist disposal, probably by using approved environmental symbols He felt that the assessment matrices in a more comprehensive list could compile several factors and options - for example in social factors about workers health and safety issues - under each factor for investigation. Subject found the ranking in each matrix to be communicative information about a company's environmental activities, and that can be included in the annual environmental report or other similar publications.

C17. The subject felt that the model is an extremely good interpretation of environmental management systems for design. Subject found that the model is a generic solution formatted in a precise and direct form, with clear indications of the directions to be followed and precisely use of the terminology. He also found the sub-models to be very useful for packaging businesses and that they work well and explain the points in relation of the main model. Subject felt that the model has a practical application and confront with the scope of EMS. Moreover, unique factor about the model is the way that indicated the role and the formulation of environmental concepts for packaging in relation to environmental management systems. Subject felt that the model can be used by company of any size and, he recommended the use of the model to be repetitive every two or three years. He suggested that the model should be used by environmental managers, environmental auditors and design managers. He also found it practical to be used an independent environmental auditor/ consultancy and design /consultancy. And, he thought that the model can also be used by an accreditation/ certification body on environmental management system as it apply in that level of standards.

The concept of the assessment matrix was also evaluated with the subject and he was very supportive in the suggested extension - matrix - in the use of the model. In particular, subject felt that the matrix provided valuable specifications for paper packaging as a part of the EMCS *model* to formulate decisions for packaging design. Subject also found the use of the Eco-points appropriate for paper and board packaging. He felt that the matrix offers a multi-considerations of the .different levels of environmental commitments within paper packaging business, and that the formulation of the matrix and eco-points is a way for an environmental declaration for paper packaging products. He found the checklist for packaging to be very useful in formulating decisions for packaging design and controlling the packaging design process. Subject recommended that the matrix should be completed by the environmental manager with the Design Manager of the company. The Eco-points should be awarded by an external environmental verifier after a site inspection. In relation to the ranking in each matrix subject felt that should be publicly available.

C18. The subject found that the EMCS model to be an extremely good interpretation of environmental management principles applicable for packaging design. In relation to the format of the model subject found clear and precise the direction, and the use of terminology easy to understood. She felt that and the sub-models work well and explain the points in support of the main model. She also felt that the accompanied document is very clear and informative. Subject found that the model indicates well the value of design as the centre of business activities to achieve sustainability goals. Furthermore, she found that the model has practical application to be used by packaging companies. In particular she found that the model can be used in the managerial level of the company. In particular, by environmental managers, environmental auditors and design managers. She also felt that the model can be used by an accreditation/ certification body on environmental management system, on the way to develop and explore environmental standards for packaging. Finally, she suggested that the period of registration can be every three years but, each sub-model can be used independently and periodically annually or twice a year or even when required in order to confirmed that the particular process operates efficiently.

The subject was positive in the concept of the matrix as extension of the EMCS model. Subject felt that the matrix provided valuable specifications to formulate decisions for packaging design and, he found the use of the Eco-points appropriate for paper and board packaging. Subject also recommended the use of each factor in the matrix in a reverse order, or independently from each other in order to indicate areas of environmental concern to be considered when formulating decisions for packaging design. Finally, subject felt that it is important to support and explore environmental guidelines through feasibility studies that reducing the negative and enhancing the positive impact of packaging, She said that by using the different assessment matrix templates for paper based packaging a list of factors are provided to be examined.

C19. The subject found that the EMCS model provides a feasible, structural and precise framework to conduct environmental management initiatives compatible with the packaging design process. Subject found the presented material of an exceptional good quality. Specifically he found the directions provided clear and accurate, the use of terminology efficiently. And, the complimentary document well described the points described on the models. In relation to the sub-models subject felt that are well described the stages for environmental analysis to be followed. With respect to the sub-model of operation at product level he suggested to considered changing the wording 'eco-design characteristics' to 'eco-design considerations' for a better description of the process. Subject felt that the model provide guidance for

practical application and that the model can be used by environmental managers, environmental auditors and design managers also, by an independent environmental auditor/ consultancy and design /consultancy. He found the model to be applicable by company of any size and in relation to the period of registration he felt that this should be every three years or otherwise with regards to the introduction of a new product, or improvements on an existing product, or industrial facilities.

Subject felt that both the EMCS and the assessment matrix emphasised the crucial role of the design management in participating in business operation towards environmental improvements. He found that the *Ecological Balance Sheet* Assessment Matrix for paper packaging products gives specifications for paper packaging as an extension in the use of the EMCS model to formulate decisions for packaging design. In particular, he felt that the use of the matrix provides a good way in considering the different levels of environmental commitments within paper packaging business, and has potential to be used for environmental declaration for paper packaging products. Subject found the checklist appropriate for use by design and environmental managers, he felt that design consideration should specified options for packaging to be re-used, recycled or incinerated.

C20. The subject found the format of the EMCS model to be an extremely good interpretation of environmental management principles applicable for packaging design. Subject found the directions to provide a precise step-by-step framework for conducting environmental analysis. He also felt that the terminology is easy to understood and well explained in the accompanied document. He believed that the sub-models illustrated adequately well the points in support of the main model. Subject recommended that the model should be used by design managers environmental managers and environmental auditors. He indicated also, that the model can be used by a team that represented by people from the above professions. He suggested that the period of registration to be every three years.

Subject found that the matrix is an applicable extension in the use of the model. In addition, he found that the indications in both the model and matrix contribute for the development of standardization procedures for packaging products. environmental acceptability. Subject also expressed his interest in the use of the different assessment matrix templates and he found useful the list of factors provided to be examined. In addition, subject found the use of the checklist for packaging design to be very useful and the fundamental considerations indicated very practical and appropriate.

C21. The subject found the model to interpreted in an extremely good way instructions for the process of packaging design under the spectrum of environmental management systems. Subject found the material presented useful, the model well formatted, and the instructions and directions well established. She found the accompanied document well written. And, that the sub-models interpreted well the relation of the packaging product with the formulation of environmental management systems. She further recommended that in the sub-model about the operation of the model at product level the 'design characteristics' should be amended to 'eco-design considerations'. Moreover, subject felt that is clearly that the model can be used in practice by environmental managers, environmental auditors and design managers. She suggested that the model can be used for the introduction of new products or services and, by company of any size.

The concept of the assessment matrix was also evaluated with the subject that she felt that the matrix provided valuable specifications for paper packaging as a part of the EMCS *model*. She also found the use of the Eco-points suitable for paper and board packaging. She believed that the matrix and the eco-point is a good format for environmental declaration for paper packaging products. In addition, subject found the checklist for packaging very useful in formulating decisions for packaging design and also for checking and controlling the packaging design process. Subject recommended the assessment matrix to be completed by the environmental manager and the design manager. She felt that the Eco-points should be awarded by an accreditation body.

C22. The subject felt that the model is a good instructional, practical model for managing the environmental implications of packaging design. Moreover, subject felt that the model provided clear and precise step-by-step direction on how to proceed in achieving environmental performance initiatives. In addition, that the use of terminology is easy to understood and the sub-models work well and explain the points in support of the main model. Subject felt that the model provided has clear potentials to be used in practice by environmental managers, environmental auditors and design managers. In addition, subject

felt that the model can also be used by an independent environmental auditor/ consultancy and design /consultancy. And that the model has potential to create specifications and environmental standards for packaging. For the period of registration it has been suggested to be every three years.

Subject expressed his interest in the use of the assessment matrix to emphasise design decisions. He also felt that is an appropriate extension for the use of the model in relation to design specifications. He recommended that the matrix should be completed by an environmental auditor, environmental manager and design managers. Moreover, subject felt that the assessment matrix is a tool for design managers to create design briefs and assess design development. In relation to this point he found the checklist that applies in the design factors of the matrix, to provide a good number of environmental considerations for the design of packaging.

EMCS MODEL Evaluation. *2nd Phase* - Demographics of the Subjects

Candidate	Occupation	Geographical area	Business activity	Number of employees	Turnover
C1.	Head of Production	Lancashire	Packaging retailer Manufacturer	250-499	£26-£50 million
C2.	Managing Director	Berkshire	Packaging retailer Manufacturer	1000+	Over £100 million
C3.	Environmental Advisor	London	Packaging retailer Manufacturer	100-249	£26-£50 million
C4	Packaging Specialists	Leeds	Packaging retailer Manufacturer	100-249	£51-£100 million
C5.	Head of Production	Surrey	Packaging retailer Manufacturer	100-249	£26-£50 million
C6.	Packaging Engineer	Hertz	Packaging retailer	1-49	£6-£10 million
C7.	Packaging Specialists	Manchester	Packaging Manufacturer	50-99	£11-£25 million
C8.	Packaging Engineer	Lancs.	Packaging and board suppliers	250-499	£51-£100 million
C9.	Mill Manager	Leicester	Packaging and board suppliers	250-499	£26-£50 million
C10.	Head of Production	Manchester	Packaging and board suppliers	50-99	£6-£10 million
C11.	Packaging Specifier	London	Packaging and board suppliers	100-249	£51-£100 million
C12.	Environmental Advisor	Surrey	Environmental Consultancy	50-99	£26-£50 million
C13.	Manager	London	Environmental Consultancy	50-99	£26-£50 million
C14.	Environmental Advisor	Milton Keynes	Environmental Consultancy	50-99	£6-£10 million
C15.	Environmental Advisor	London	Environmental Consultancy	100-249	£51-£100 million
C16.	Environmental Advisor	Middlesex	Environmental Consultancy	1-49	£1-£5 million
C17.	Project Manager	Milton Keynes	Design Consultancy	1-49	£6-£10 million
C18.	Head of Design	London	Design Consultancy	100-249	Over £100 million
C19.	Chief Designer	London	Design Consultancy	50-99	£26-£50 million
C20.	Chief Designer	London	Design Consultancy	1-49	£26-£50 million
C21.	Design Manager	Hants.	Design Consultancy	1-49	£1-£5 million
C22.	Head of Design	London	Design Consultancy	50-99	£6-£10 million

Occupation	Geographical area	Business activity	Number of employees	Turnover
Head of Production/ Manager/ Director = 7 **Packaging Specialist/Specifier/ Engineers = 5** **Packaging Designers = 5** **Environmental Advisor = 5**	**UK based sites.**	**Packaging retailer Manufacturer = 7** **Packaging and board suppliers = 4** **Environmental Consultancies = 5** **Design Consultancies = 6**		

Assessment Matrix: Case Studies Index

Three case studies produced to demonstrate the applicability of the matrix recommended to be used as an extension of the EMCS *model* for environmental awarding for paper based packaging. The following tables present the instruments used to produce the case studies and the completed matrices, examining four factors: *Design, Manufacturing, Legal/Social, and Performance factors* in each case study. Following this is the evaluation method used to prove the validity and reliability of the case studies and the findings.

Table VII.1 Instrument used in Case Studies

The instrument used for the case studies and assessment matrices were: (1) the completed questionnaire from the second survey from each company described in the case studies, (2) official and unofficial documents provided by the participants of the second survey, (3) evaluation of the material from stage one and two to complete the matrices and produce each case study, (4) evaluation of each case study and completed matrix and (5) final modifications.

The following tables present the results for each factor of the matrix, used for each case study. Those results are used in for completing the summary matrix presented in chapter 8

Table VII.1.1 Instrument used in Vignette Case Study One *Aston Packaging*

Paper based packaging Life cycle stages

Design Factors	Pre - Production	Production	Distribution	Use	After - Use	Disposal	Outputs *Summary*
Resource Consumption	◔	◕	●	●	●	●	● ●
Material Availability	◑	◑	●	●	●	●	●
Material Reduction	◔	●	●	●	●	●	●
Material Compatibility	●	●	●	●	●	●	●
Components Compatibility	●	●	●	◔	●	●	●
Process Compatibility	●	◕	●	●	●	●	●
Energy Consumption	◍	◍	◔	◔	●	●	◔
Pollution Reduction	◍	◍	◔	◔	◔	◔	◔

Aston Packaging Ltd

Stage One: Design Factors - ***Assessment Matrix for paper based packaging***

Paper based packaging Life cycle stages

	Pre - Production	Production	Distribution	Use	After - Use	Disposal	Outputs *Summary*
Legal/Social Factors							
Forestry Certificate	-	-	-	-	-	-	-
Comply with Legislative Regulatory requirements	◓	●	●	●	●	●	●
Suppliers Audit	◑	◑	-	-	-	-	◔
Considering Community Needs	●	●	●	●	●	●	●
Motivate Employments	◑	◑	◕	-	-	●	◔

Aston Packaging Ltd

Stage three: Legal/Social Factors - ***Assessment Matrix for paper based packaging***

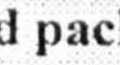
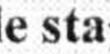
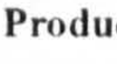
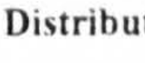
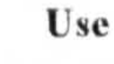
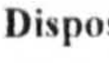
Paper based packaging Life cycle stages

	Pre - Production	Production	Distribution	Use	After - Use	Disposal	Outputs *Summary*
Performance Factors							
Cost benefit analysis	●	●	●	●	●	●	●
Competitors position	◔	●	●	◔	●	●	●
Adopt EMS	◒	◒	◒	-	-	◒	◒
Communicate Environmental Activities	●	●	◔	●	●	●	●
Investment in Environmental Improvements	●	◑	◑	●	●	◔	●

Aston Packaging Ltd

Stage Four: Performance Factors - ***Assessment Matrix for paper based packaging***

Table VII.1.2 Instrument used in Vignette Case study Two: *Arjo Wiggins Fine Papers Ltd*

	Paper based packaging Life cycle stages						
	Pre - Production	**Production**	**Distribution**	**Use**	**After - Use**	**Disposal**	**Outputs *Summary***
Design Factors							
Resource Consumption							
Material Availability							
Material Reduction							
Material Compatibility							
Components Compatibility							
Process Compatibility							
Energy Consumption							
Pollution Reduction							

Arjo Wiggins Fine Papers Ltd. Stage One: Design Factors - *Assessment Matrix for paper based packaging*

	Paper based packaging Life cycle stages						
	Pre - Production	**Production**	**Distribution**	**Use**	**After - Use**	**Disposal**	**Outputs *Summary***
Manufacturing Factors							
Resource Consumption							
Material Compatibility							
Components Compatibility				-			
Process Compatibility				-			
Energy Consumption							
Water Contamination			-	-			
Air Contamination				-			
Manufacturing Waste	-			-	-		

Arjo Wiggins Fine Papers Ltd. Stage Two: Manufacturing Factors -*Assessment Matrix for paper based packaging*

Paper based packaging Life cycle stages

	Pre - Production	Production	Distribution	Use	After - Use	Disposal	Outputs *Summary*
Legal/Social Factors							
Forestry Certificate	-	-	-	-	-	-	-
Comply with Legislative Regulatory requirements	●	●	●	●	●	●	●
Suppliers Audit	●	◕	-	-	-	-	◕ ●
Considering Community Needs	●	●	◕	◕	▨	◕	◕
Motivate Employments	◕	◕	◕	-	-	◕	◕

Arjo Wiggins Fine Paper Ltd

Stage three: Legal/Social Factors - *Assessment Matrix for paper based packaging*

Paper based packaging Life cycle stages

	Pre - Production	Production	Distribution	Use	After - Use	Disposal	Outputs *Summary*
Performance Factors							
Cost benefit analysis	◕	◕	◕	●	▨	●	◕
Competitors position	◕	●	◕	●	◕	◕	◕
Adopt EMS	●	●	●	-	-	●	●
Communicate Environmental Activities	●	●	◕	●	▨	●	●
Investment in Environmental Improvements	◕	●	◕	◕	◕	◕	◕

Arjo Wiggins Fine Paper Ltd

Stage Four: Performance Factors - Assessment Matrix for paper based packaging

Table VII.1.3 Instrument used in Vignette Case study Three: ***AssiDomän Packaging Manufacturer***

	Paper based packaging Life cycle stages						
	Pre - Production	**Production**	**Distribution**	**Use**	**After - Use**	**Disposal**	**Outputs** *Summary*
Design Factors							
Resource Consumption	◔	●	◕	⬭	◔	●	◕
Material Availability	◔	◕	-	⬭	⬭	●	◔
Material Reduction	◕	◕	◕	⬭	◕	◕	◕
Material Compatibility	◔	◔	◕	⬭	⬭	⬭	⬭
Components Compatibility	◔	◕	◕	◕	◔	◔	◕
Process Compatibility	◕	◕	◕	◕	◕	●	◕
Energy Consumption	◕	●	◕	⬭	⬭	●	◕
Pollution Reduction	◔	◕	◕	⬭	◕	●	◕

AssiDomän Stage One: Design Factors- ***Assessment Matrix for paper based packaging***

	Paper based packaging Life cycle stages						
	Pre - Production	**Production**	**Distribution**	**Use**	**After - Use**	**Disposal**	**Outputs** *Summary*
Manufacturing Factors							
Resource Consumption	●	●	●	◕	◔	●	●
Material Compatibility	●	●	◕	◕	◔	●	◕
Components Compatibility	◕	●	●	●	◔	◔	◕
Process Compatibility	●	●	●	-	◔	●	●
Energy Consumption	●	●	●	●	●	●	●
Water Contamination	●	●	-	-	⬭	●	●
Air Contamination	●	●	●	-	⬭	●	●
Manufacturing Waste	-	●	●	-	-	●	●

AssiDomän Stage Two: Manufacturing Factors -*Assessment Matrix for paper based packaging*

Paper based packaging Life cycle stages

	Pre - Production	Production	Distribution	Use	After - Use	Disposal	Outputs *Summary*
Legal/Social Factors							
Forestry Certificate	●	●	●	●	-	-	●
Comply with Legislative Regulatory requirements	●	●	●	●	●	●	●
Suppliers Audit	◔	◔	-	-	-	-	◔
Considering Community Needs	◔	◔	●	●	◔	●	●
Motivate Employments	●	◔	●	-	-	●	●

AssiDomän

Stage three: Legal/Social Factors - *Assessment Matrix for paper based packaging*

Paper based packaging Life cycle stages

	Pre - Production	Production	Distribution	Use	After - Use	Disposal	Outputs *Summary*
Performance Factors							
Cost benefit analysis	●	●	●	◔	◔	●	●
Competitors position	◔	●	●	◔	◔	●	●
Adopt EMS	●	●	●	-	-	●	●
Communicate Environmental Activities	●	●	●	●	●	●	●
Investment in Environmental Improvements	●	●	●	◔	◔	●	●

AssiDomän

Stage Four: Performance Factors - *Assessment Matrix for paper based packaging*

Table VII.2 Instrument used in Case Studies Evaluation

The companies that are presented in the case studies were contacted with the request to participate in assessing and confirming the credibility and reliability of the presented material. Initially the companies were contacted by phone to inform them that they are going to receive the case studies for evaluation. Each subject was sent a copy of the project description, the matrix tables and the document explaining how the matrix operates, a copy of the EMCS *model* and a document explaining how the model works and a copy of the case study for their company. In addition, one page evaluation questionnaire that assessed the case study and the use of the matrix was sent. The evaluation questionnaire was accompanied by a SAE. The evaluation questionnaire included the following six items.

1. Is it easy for you to understand the use of the assessment matrix that this study recommends?
2. Do you find the information on the Case Study about Arjo Wiggins Fine Papers Limited *(this is replaced each time by the name of the company contacted)* Environmental profile gives a good description of your companys' environmental activities?

   Please feel free to make any amendments.
3. Do you find adequate enough the ranking scoring in each matrix for your company?

   Please feel free to suggest any changes.

   For this purpose a blank copy of the four stages of the matrix are provided.
4. Do you think that the assessment matrix works well in conjunction with the EMCS model?
5. Do you believe that the EMCS model and the matrix provide useful guidelines for packaging companies to manage and assess their environmental performance?
6. If you like to offer any comment about the EMCS model/ the matrix or the research project it would be considered extremely valuable.

   Please continue to a separate page if required.

Thank you very much for your time and co-operation.

Table VII.3 Results from Case Studies Evaluation

One of the respondents send back the completed evaluation sheet, the other two were contacted by phone for the purpose of the evaluation. Their comments were as follows.

Arjo Wiggins Fine Papers Ltd

From the *Arjo Wiggins Fine Papers Ltd* the person in the position of Fine Papers Environmental Adviser was contacted for evaluation of the case study and the matrix. He expressed his agreement in the use of the assessment matrix for his company. He commented about the case study of *Arjo Wiggins Fine Papers Ltd* that the 1994 environmental report and the 1997 *'Arjo Wiggins Fine Papers Environmental Report'* are two separate reports that are different and not two different versions of the same report as presented in the copy of the case study that he received.

AssiDomän Packaging Manufacturer

From the *AssiDomän Packaging Manufacturer* the person in the position of Engineer that deals with environmental issues was contacted for evaluation of the case study and the matrix. He expressed his agreement about the way that the assessment matrix was completed for his company. In addition he did not suggest any amendments to the information about his company presented in the case study.

Aston Packaging

Evaluation Questionnaire

Assessment Matrix

Manufacturing factors are also a key part of our business.
We recycle our own corrugated paper waste / off cuts which constitutes 30% of the material content of our moulded paper pulp products.
We also make significant energy cost savings in our pulp mould 'drying' process. Conventional methods facilitate high-energy gas heated chambers, whereas we use low heat / dehumidifier ovens that recycle warm air and produce distilled water as a by-product.

Case Study

It is a fair description, but we also have a timber pallet reuse system similar to the box reuse system and also ship ALL our products out on refurbished timber pallets.
We have converted our plant steam generator from oil to dual fuel gas / oil which has implications of greater energy efficiency / use of cleaner fuels etc.

Matrix Scoring

Yes, areas on each matrix that you have highlighted as 'weaker' are now being addressed more seriously.
We are currently committed to BS EN ISO 9001 : 1994 accreditation by the end of 1999 closely followed by ISO 14001.

ENCS / Matrix use

We recognise the need for continuous audit of our suppliers and our own environmental actions / performance. The EMCS model provides a useful guideline and I believe your matrix allows a good summarisation of the direct issues concerning companies' environmental responsibilities.

I hope this helps you with your research.

Best regards

Dave Gill

Tel : 0121 327 0411 Fax : 0121 328 0067
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List of Events attended

> ***1995*** ***Toward Sustainable Design. Conference,*** The Centre for Sustainable Design, The Surrey Institute of Art & Design, Farnham, Surrey, UK, 6th July 1995

> ***1995 - East Midlands Region Environmental Conference, 'Developments in environmental Management systems',*** Wednesday 12 July 1995, The Nottingham Trent University. Clifton Campus.

> ***4D Dynamics.*** Conference, De Montfort University, UK, September 1995

> ***Managing Commercial and Industrial Waste,*** Event. London. International Conference Group. 13-14 November 1995

> ***Packaging Principles and Practice.*** Session Institute of Packaging, 13-17 November 1995

> ***Pakex*** 1995. Exhibition. NEC Birmingham, UK, 3-7 April 1995

> ***Retailpack '95***. Exhibition, Olympia Exhibition Centre, London, 28-30 November 1995

> ***A way with waste*** - European Recycling Conference and Exhibition, Local Authority Recycling Advisor Committee, Fifth LARAC Conference, Bournemouth 9-10 Oct. 1995

> ***Creative Packaging Exhibition.*** Wembley Exhibition Centre, London, 14-16 November 1995

> ***Eco-Radicalism***. Seminar. Manchester University, UK, 12th November 1995

> ***'Whose Values?' - Ethics in the International Business Environment,*** organised by Thames Valley University, March 18-20 1996. Park Court Hotel, Bayswater Road, London,

> ***Designing Design Research: 1***. Seminar. School of Design and Manufacture. De Montfort University, UK. 6Th December 1996.

> ***Material World II: Ecological Textile Design Conference***. Birmingham Institute of Art and Design. 12Th November 1996

> ***National Packaging Plus Exhibition.*** London Arena Exhibition Centre. 1-3 October 1996

> ***Packaging Focus '96,*** Southampton, Richmond Events. 4-7 July 1996

> ***Packaging Plus***, National Packaging Exhibition Event, Wembley, London, 12-14 Nov. 1996

> ***PPMA Show.*** Exhibition. National Exhibition Centre. Birmingham. 5-7 November 1996

> ***Producer Responsibility for Packaging Waste - What does it mean for business?'.*** Institute of Environmental Management and the Department of the Environment. Lucas Industries. Birmingham. 22nd July 1996

> ***Recycling Exhibition***. Warwick Art Centre. Exhibition and Seminar Series. 16th Nov. 1996

> ***RSA. Student Design Awards.*** Seminar. De Montfort University. UK, 28th February 1996

> ***The 8th International Forum on Design Management Research and Education'.*** Design Management Institute. November 20-23. 1996 Barcelona. Spain

> ***Worldesign '96 Conference. 'Alternatives Realities',*** organised by the Industrial Society of America - IDSA, September 18-21 1996. Dolphin Hotel. Walt Disney World., USA.

> ***Centre for Environmental Strategy, University of Surrey, Open Day,*** 11th September 1997, University of Surrey, Guilford

> ***Environmental Software Demonstration***. Olympia 2, Conference Centre, 11th November 1997

> ***Environmental Technology '97.*** Exhibition. NEC Birmingham. 8-10 April 1997

> ***Green Committee Debate.*** Seminar. Chartered Society of Designers, 13th February 1997

> ***Managing Eco-Design 2.*** 2nd Annual International Conference. The Surrey Institute of Art and Design, 31 October 1997

> ***National Packaging Plus*** Exhibition, London, 7-9 October. 1997

> ***Packaging, design and environment.*** Towards Sustainable Product Design - series 1997, The Surrey Institute of Art and Design, 27th February 1997

> ***Packaging: Producer Responsibility.*** Event by the Department of Environment. Birmingham. 12th June 1997

> ***Papex '97, Paper and board making exhibition.*** Manchester. 14-16 October 1997

> ***Retailpack '97.*** Exhibition. Olympia, London. 14-16 October. 1997

> ***Designing Design Research: 2***. 'The Design Research Publication'. Seminar, School of Design and Manufacture, De Montfort University, 27th February 1998

> ***Environmental Management Performance Measurement.*** Institute of Environmental Management. Rolls -Royce Training Centre, Derby. 19th Jan. 1998

> ***Environmental Technology '98.*** Exhibition. NEC Birmingham. 2-4 June 1998

> ***Forum for the Future.*** Keele University Best Practice Directory Seminar Series. 21st Jan.1998

> ***Life Cycle Assessment in Practice.*** Workshop. Institute of Environmental Management. Boots Social Club; Nottingham, 17th February 1998.

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White Swan, Eco-labelling Scheme, Information Service The Nordic Council
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World Packaging Organisation, Louis P. General Secretary, USA
World Resource Foundation, Dixon S, Information Service, Kent

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3th European Congress *'Packaging & Environment' - Shared responsibilities in Financing the Management of Packaging Waste / Communication Ethics with Regard to Packaging and the Environment,* 21-22 November 1994, Brussels
8th International Forum on Design Management Research & Education , Fostering Strategic Design Cultures - Symposiun proceedings, by the Design Management Institute, 20-22 November 1996. Barcelona
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Glossary

Aerated lagoon Biological treatment method which reduces the BOD, COD, and AOX content of effluent.
AOX Absorbable organic halogen. Collective term for the quality of chlorine present bound to an organic substance. It is formed, among other things, when bleaching wood pulp with chlorinated chemicals but it is also formed naturally.
Biodegradable products Materials capable of being broken down into their constituent parts by micro-organisms and bacteria.
Bleaching A chemical process for producing a bright (white) and consistent pulp. Bleaching agents include chlorine, chlorine dioxide, oxygen and hydrogen peroxide. Chlorine is no longer used in Sweden.
BS EN ISO 14000 Commonly abbreviated to ISO 14000. A series of standards developed by the International Standards Organisation for environmental management (equivalent of BS 7750). ISO 14001 is the specification with guidance for use.
BS EN ISO 9000/ 9001/ 9002 Commonly abbreviated to ISO 9000. A series of standards developed by the International Standards Organisation for quality management systems (equivalent of BS5750). ISO 9001 relates to design, development, production, installation and servicing. ISO 9002 relate to production, installation and servicing.
BS57750 British Standards Institute for Quality Management, awarded to businesses who effectively audit and manage their production systems, now superceded by ISO 9000.
BS7750 British Standards Institute for Environmental Management, awarded to businesses who effectively audit and manage their environmental management systems.
By-product A useful product that is not the primary product being produced. In life-cycle analysis, by product are treated as co-product.
CFCs (chlorofluorocarbons) Compounds containing chlorine and fluorine found in home insulation materials, as coolants and insulating materials in fridges and air-conditioning systems.
Climate The temperature, humidity, precipitation, winds, radiation, and other meteorological conditions characteristic of a locality or region over an extended period of time.
Closed-loop recycling A recycling system in which particular mass of material is remanufactured into the same product (e.g. glass bottle into glass bottle). Also known as *Horizontal recycling*.
Co-disposal Disposing of liquid industrial waste and household domestic waste in the same site.
Co-product A marketable by-product from a process. This includes materials that may be traditional defined as wastes such as industrial scrap that is subsequently used as a raw material in a different manufacturing process.
CO_2 Carbon Dioxide. The main greenhouse gas by-product of burning fuels.
COD Chemical Oxygen Demand. Chemical oxygen-consuming material. A measure of the amount of oxygen required for complete decomposition of organic matter.
Converting The manufacturing stage when pulp and board are printed and converted into finished products.
Corrugated board A board made by gluing together two flat layers of liner with a corrugated, or wavy, layer of fluting in the middle.
Cycle A system consisting of two or more connected *reservoirs*, where a large part of the material of interest is transferred through the system in a cyclic manner.
Design for environment (DfE) An engineering perspective in which the environmentally related characteristics of a product, process, or facility design are optimised.
Dioxins A family of highly chlorinated organic compounds, some of which are toxic.
EA Environment Agency. UK organisation introduced by the 1995 Environmental Act to provide all environmental regulatory functions. Replaces the activities of NRA, HMIP and some waste regulation activities of Local Authorities. SEPA (Scottish Environment Protection Authority) is the Scottish equivalent.
ECF Element Chlorine Free. Pulp which has been bleached with Chlorine Dioxide rather than Chlorine gas. Produces very much reduced levels of Organo chlorides and virtual elimination of Dioxins.
Emission Discharge of a substance into air, land, lakes, seas or rivers.
EMS Environmental Management Systems. An externally certified system of management for an organisation which continuously monitors its environmental impact at all stages of its operation. Continuous reduction of environmental impacts is in-built.
Environmental Impact Analysis Analysis of the environmental consequences of a specific operation. Obligatory following a parliamentary decision from 1991.
Fluting The corrugated, or wavy, middle layer of corrugated board. Made from either new or recycled fibre.
FSC Forest Stewardship Council. Independent International Organisation that works to achieve "socially responsible, environmentally compatible and financially viable forest management".
Global warming The theory that elevated concentrations of certain anthropogenic atmospheric constituents or will cause in Earth's average temperature.
Grammage The weight of paper per unit of area. Measured in g/m^2.
Green accounting An informal term referring to management accounting systems that specifically delineate the environmental costs of business activities rather than including those costs in overhead accounts.
Greenhouse effect The trapping by atmospheric gases of outgoing infrared energy emitted by Earth. Part of the radiation absorded by atmosphere is returned to Earth's surface, causing it to warm.

Greenhouse gases A gas with absorption in the infrared portion of the spectrum. The principal greenhouse gases in Earth's atmosphere are H_2O, CO_2, O_3, CH_4, N_2O, CF_2CL_2, and $CFCL_3$.

Greenhouse gases Naturally occurring gases as carbon dioxide, nitrous oxide, methane, and ozone, and man-made gases.

Hardwood Wood from deciduous trees, in Sweden usually birch. Has shorter fibres than softwood. Important raw material for writing and printing papers,

Hazard A material or condition that may cause damage, injury, or other harm, frequently established through standardised assays performed on biological systems or organisms. The confluence of hazard and exposure create *Risk.*

High-grade recycling Where the recycling process creates items of comparable, or only slightly lowered, quality to the original.

Horizontal recycling See *Closed-loop recycling.*

Impact analysis The second stage of life-cycle assessment, in which the environmental impacts of a process, product, or facility are determined.

Improvement analysis The third stage of life-cycle assessment, in which design for environment techniques are used in combination with the results of the first and second LCA stages to improve the environmental plan, process, product, or facility.

Industrial ecology An approach to the design of industrial products and process that evaluates such activities through the dual perspectives of product competitiveness and environmental interactions.

Inventory analysis The first stage of life-cycle assessment, in which the inputs and outputs of materials and energy are determined for a process, product or facility.

IPC Integrated Pollution Control. UK Environmental legislation aimed at preventing harmful emissions. Emissions to Air, Land and Water are considered together.

kg kilogram

Kraftliner High-strength liner, mainly produced from softwood sulphate pulp.

Life-cycle The stages of a product, process, or package's life, beginning with raw materials acquisition, continuing through processing, materials manufacture, product fabrication, and use, and concluding with any of a variety of waste management options.

Life-cycle assessment (LCA) A concept and a methodology to evaluate the environmental effects of a product or activity holistically, by analysing the entire life cycle of a particular material, process, product, technology, service or activity. The life-cycle assessment consists of three complementary components inventory analysis, impact analysis, and improvement analysis together with an integrative procedure known as scoping.

Low-grade recycling Where materials are recycled and the end results is a product that is either weaker or lower in quality than the original.

Market pulp Pulp (bleached or unbleached) sold to papermills that do not produce their own pulp.

Mechanical pulp Pulp production method where the wood fibres are released mechanically, instead of chemically.

Mill Broke Waste generated within the paper-making process (normally returned to the process).

MJ megajoule (1 million joule)

NAMP National Association of Paper Merchants (UK). An NAMP approved recycled paper must contain at least 75% waste. No mill broke is included.

National Licensing Board for Environmental Protection Handles applications for production licenses (concessions) which large installations and industries are required to acquire according to the Environment Protection Act. Based on the Board's investigations, terms and conditions which apply from an environmental standpoint are decided upon.

Natural forest Forest that has been untouched by man for a long period so that it to a large extent has acquired the characteristics of a virgin forest.

Nitrogen (N) A chemical element natural in wood. Excess nitrogen in water can cause eutrophication which in turn can lead to oxygen deficiency during decomposition.

NO_x Nitrogen Oxides. Acidifying emissions associated with burning fuels (especially coal). The sum of the common pollutant gases NO and No_2.

Old growth forest Forest which contains animal and plant life with a long continuity.

Open-loop recycling A recycling system in which a product from one type of material is recycled into a different type of product (e.g., plastic bottles into fence posts). The product receiving the recycled material itself may or may not be recycled. Also known as *Cascade recycling.*

Ozone (O) A form of oxygen with a strong tendency to oxidise other substances. Used in various types of bleaching.

Ozone depletion The reduction in concentration of stratospheric ozone as a consequence of efficient chemical reactions with molecular fragments derived from anthropogenic compounds, especially CFCs and other halocarbons.

Packaging, primary The level of packaging that is in contact with the product. For certain beverages, an example is the aluminium can.

Packaging, secondary The second level of packaging for a product that contains one or more primary packages. An example is the plastic rings that hold several beverage cans together.

Packaging, tertiary The third level of packaging for a product that contains one or more secondary packages. An example is the stretch wrap over the pallet used to transport packs of beverage cans. Also, known as *transportation* packaging.
Particle emissions Particles of ash which are formed during incineration of materials such as bark or liquor.
Phosphorous (P) A chemical element natural in wood. Too much phosphorous in waste water can cause eutrophication in lakes and lead to oxygen deficiency during decomposition.
Pilot plant A facility larger than a test unit in a laboratory but smaller than that in a full scale production factory, built to test new technology under manufacturing conditions.
Post-consumer solid waste A material that has served its intended use and has become a part of the waste stream. Also called *Old scrap* and *Post-consumer scrap.*
Post-Consumer Waste A recycled term which describes material which has been used for its final intended use.
Pre-Consumer Waste A recycled waste term which describes material which has not been used for its final intended use. It does not include mill broke.
Producer's liability Means that anyone engaged in the commercial manufacture, import or sale of a product/ packaging must ensure that the used product/ packaging is removed and reused or recycled.
Productive forest land Forest land which produces on average at least $1m^3$ wood per hectare and year over a one hundred year period.
Recycle fibre Fibre material that has previously been used in a paper or board product.
Risk The confluence of exposure and hazard; a statistical concept reflecting the probability that an undesirable outcome will result from specified conditions such as exposure to a certain substance for a certain time at a certain concentration.
Risk assessment An evaluation of potential consequences to humans, wildlife, or the environment caused by a process, product, or activity, and including both the likelihood and the effects of an event.
Sack-paper Paper with high strength properties used for the production of sacks. Made from softwood sulphate pulp.
Semi-chemical pulp Pulp in which the fibres are freed through a combination of chemical and mechanical (grinding) treatment.
Softwood Wood from coniferous trees, pine or spruce. Has longer and stronger fibres than hardwood.
Solvent A medium, usually liquid, in which other substances can be dissolved.
SO_x Sulphur Oxides. Acidifying emissions associated with burning fossil fuels (especially coal).
Sulphate pulp Chemical pulp produced by digesting wood at a high pressure and temperature in a sulphate liquor known as white liquor (sodium hydroxide and sodium sulphide). Sulphate pulp is also known as kraft pulp.
Sulphur dioxide (SO_2) A gas consisting of sulphur and oxygen formed during combustion of sulphur-containing fuels such as black liquor and oil. On contact with moist air, sulphur dioxide forms acid which fails as acid rain.
Suspended solids (SS) Substances suspended in water consisting of fibres and other particles that can be separated using a filter.
TCF Total Chlorine Free. Pulp which has been bleached with agents such as Oxygen or Hydrogen Peroxide, which contains no Chlorine compounds at all. Produces no detectable levels of Dioxins or Organo-chlorides above natural background levels.
TEF Totally Effluent Free. Terminology associated with pulp or paper mills which have zero effluent (or emissions). This is normally regarded as an ultimate objective, to which companies should aspire.
Testliner Liner mainly produced from recycled fibre.
Virgin Forest Forest that has never been affected by human activities.
Wood room The section of a pulp mill where bark is removed from the logs and the wood is cut into chips.

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